UNITED STATES DEPARTMENT OF COMMERCE
Office of the Under Secretary for
Oceans and Atmosphere
Washington, D.C. 20230

MAR - 9 1998

To All Interested Government Agencies and Public Groups:

Under the National Environmental Policy Act, an environmental review has been performed on the following action.

TITLE: 1998 Groundfish Total Allowable Catch Specifications Under the Fishery Management Plans for the Groundfish Fishery of the Bering Sea and Aleutian Islands Area and the Groundfish Fishery of the Gulf of Alaska

LOCATION: Exclusive Economic Zone off Alaska

SUMMARY: This document documents the analysis of the groundfish target species stock status, higher and lower trophic level species, and the physical and socioeconomic environment. The federal action consists of proposing the 1998 total allowable catch specifications for the Bering Sea and Aleutian Islands management area and the Gulf of Alaska management area. The specified total allowable catch will become the upper limit of groundfish harvested in the groundfish fisheries off Alaska during calendar year 1998.

RESPONSIBLE OFFICIAL:
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The environmental review process led us to conclude that this action will not have a significant impact on the environment. Therefore, an environmental impact statement was not prepared. A copy of the finding of no significant impact, including the environmental assessment, is enclosed for your information. Also, please send one copy of your comment to me in Room 5805, PSP, U.S. Department of Commerce, Washington, D.C. 20230.

A supplemental environmental impact statement (SEIS) is in preparation for future review of this fishery. A notice of intent to produce an SEIS was published in the Federal Register on March 31, 1997 (62 FR 15151). A review draft of the SEIS is anticipated to be completed in April, 1998. A final SEIS will be completed prior to filing the 1999 harvest specifications.

Sincerely,

Susan Fruchter

Susan Fruchter
Acting NEPA Coordinator

Enclosure

ENVIRONMENTAL ASSESSMENT FOR 1998 GROUNDFISH TOTAL ALLOWABLE CATCH SPECIFICATIONS IMPLEMENTED UNDER THE AUTHORITY OF THE FISHERY MANAGEMENT PLANS FOR THE GROUNDFISH FISHERY OF THE BERING SEA AND ALEUTIAN ISLANDS AREA AND THE GROUNDFISH FISHERY OF THE GULF OF ALASKA AREA

March 2, 1998

Lead Agency:	National Marine Fisheries Service Alaska Fisheries Science Center Seattle, Washington and the Alaska Regional Office National Marine Fisheries Service Juneau, Alaska
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Abstract: The Environmental Analysis documents the analysis of the groundfish target species stock status, higher and lower trophic level species, and the physical and socioeconomic environment. The federal action consists of proposing the 1998 total allowable catch specifications for the Bering Sea and Aleutian Islands management area and the Gulf of Alaska management area. The specified total allowable catch will become the upper limit of groundfish harvested in the fisheries during calendar year 1998.

SUMMARY

This environmental assessment presents a brief analysis of the environmental impacts associated with changing the total allowable catch (TAC) amounts from those set in 1997 to those proposed for 1998 for the federally managed Groundfish Fisheries in the Bering Sea and Aleutian Islands Management Area (BSAI) and in the Gulf of Alaska (GOA). Alternative actions include the final 1998 TAC specifications recommended by the North Pacific Fishery Management Council (Council) as compared to the 1997 TAC specifications as published in the final specification for the 1997 fisheries (BSAI 62 FR 7168, February 18, 1997; GOA 62 FR 8179, February 24, 1997). Potential impacts of the proposed 1998 TAC specifications compared to the 1997 TAC specifications on target groundfish species categories, higher trophic level species, Endangered Species Act listed species, habitat, other predators and prey which together constitute the ecosystem, and socioeconomic impacts are addressed.

Updated information on the status of groundfish stocks was reviewed by the Plan Teams for the groundfish fisheries of the BSAI and GOA at their September and November 1997 meetings, and was presented in the final Stock Assessment and Fishery Evaluation (SAFE) Reports for the Groundfish Resources of the BSAI and GOA as Projected for 1998 (NPFMC 1997a; b). Using the best available information, the Plan Teams determined biomass, the overfishing levels (OFLs), and acceptable biological catches (ABC) and TAC for the 1998 fisheries and recommended them to the Council in the SAFE reports. After reviewing the current information, the Council recommended 1998 TAC specifications.

The sums of the recommended final 1998 ABC and OFLs specifications from the SAFE reports, and the TAC specifications as recommended by the Council follow.
The Optimum Yields (OY) were established in the Fishery Management Plans for the Groundfish Fishery of the BSAI (NPFMC 1995) and the GOA (NPFMC 1994).

parameters	BSAI	GOA
OY	2,000,000	800,000
ABC	2,454,976	548,770
TAC	2,000,000	324,456
OFL	4,202,451	817,270

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1.0 PURPOSE AND NEED FOR ACTION

The groundfish fisheries in the Exclusive Economic Zone (EEZ) (three to 200 nautical miles (nm) offshore) off Alaska are managed by the U.S. Department of Commerce approved fishery management plans (FMPs). The Groundfish of the Gulf of Alaska (GOA) FMP was approved and became effective in 1978 and was rewritten to incorporate minor changes in 1994 (NPFMC 1994). The Groundfish Fishery of the Bering Sea and Aleutian Island Area (BSAI) became effective in 1982 and was also rewritten to incorporate minor changes in 1995 (NPFMC 1995). The fishing year follows the calendar year, January 1 to December 31. The GOA is divided into three areas western, central, and eastern) and eight reporting areas. The BSAI is divided into two areas (eastern Bering Sea and Aleutian Islands) and nineteen reporting areas. Both FMPs were prepared by the Council under the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). Optimum yield (OY) established in the BSAI FMP is limited to two million metric tons (mt). OY established in the GOA FMP is limited to 800,000 mt. The FMPs also establish that TAC for each fishery be set annually by the Secretary of Commerce (Secretary) in consultation with the Council in response to current stock assessment information. The intended effect is to conserve and manage the groundfish and pelagic resources in the North Pacific Ocean.

Regulation of the groundfish fisheries include a myriad of interrelated regulations directing time and area closures, gear restrictions, upper catch limits of prohibited species and other bycatch species, and community (license specific) quotas. The process of setting TAC is set up by the FMPs as an annual process for target species and other species. Since 1990, specification of interim harvest levels are made for the first quarter of the fishing year. The Secretary implements one-fourth of the interim TAC specifications and one-fourth of each PSC allowance and apportionments thereof toward fisheries occurring in the first quarter of the calendar year. Following completion of analysis of any new stock status information and its presentation at the December meeting, the Council forwards the final TAC recommendations to the Secretary. The final groundfish harvest specifications and prohibited species bycatch allowance supersede the interim specifications when approved by the Secretary. The entire amount is available to the domestic fishery.

Actions taken to amend FMPs or implement other regulations governing the groundfish fisheries must meet the requirements of Federal laws and regulations. In addition to the Magnuson-Stevens Act, these include the National Environmental Policy Act (NEPA), the Endangered Species Act (ESA), the Marine Mammal Protection Act (MMPA), Executive Order 12866, and the Regulatory Flexibility Act.

Toward maintaining compliance with NEPA, an environmental analysis (EA) document is prepared annually analyzing the next year's proposed TAC in comparison with the current year TAC. This particular EA analyzes possible environmental impacts of harvesting at the proposed 1998 TAC specifications as compared to the 1997 TAC specifications. This EA is based upon Environmental Impact Statements that were prepared in 1978 for the GOA FMP and in 1981 for the BSAI FMP. Since the EISs were prepared, the fisheries have evolved, the management plans governing the fisheries have been amended numerous times, there is new information available concerning the BSAI and GOA ecosystems, and several birds and marine mammal species have been listed as threatened or endangered under the Endangered Species Act. In response to those concerns, a Supplemental Environmental Impact Statement (SEIS) is being prepared. However, though preparation of the SEIS began in February of 1997, it is not possible to complete an SEIS in one year that completely and accurately examines the impacts of the groundfish fisheries on the human ecosystem and allows for full public participation in the process. A notice of intent to produce an SEIS and a schedule of scoping meetings was published in the Federal Register on March 31, 1997 (62 FR 15151). Scoping meetings were held in Anchorage, Dutch Harbor, Juneau, Ketchican, Kodiak, Portland, Seattle, and Sitka during June. Based upon the results of the scoping process, a review draft of the SEIS is scheduled for completion in April. A final SEIS will be completed prior to filing the 1999 harvest specifications.

Groundfish stock status is monitored and interpreted by the National Marine Fisheries Service (NMFS) to the Council via established and annually repeated pathways. Groundfish population surveys are conducted for the various species and species groups over regularly repeated time intervals by NMFS in the respective areas. Results are reported to the Council appointed Plan Teams for display in their annual preliminary and final Stock Assessment and Fishery Evaluation (SAFE) reports. The SAFE reports contain a review of the latest scientific analyses and estimates of each species' biomass, acceptable biological catch (ABC) and other biological parameters, as well as summaries of the ecosystem and the economic condition of groundfish fisheries off Alaska. The process of setting ABC and TAC specifications includes an analysis of a level of fishing that constitutes the overfishing level (OFL). Amendment 44 to the GOA and BSAI Groundfish FMPs re-define ABC and OFLs; including creation of a buffer between ABC and OFL. The revised definitions were used for the 1997 and 1998 TAC specification process.

The final 1998 SAFE reports (NPFMC 1997a; b) incorporate biological survey work completed during the summer of 1997, any new methodologies applied to obtaining these data, and ABC and OFL determinations that are based on the most recent stock assessments. At its September and December 1997 meetings, the Council, its Advisory Panel, and its Scientific and Statistical Committee, and its Ecosystem Committee reviewed the SAFE reports and made recommendations based on that information about the condition of groundfish stocks in the respective fishing areas. The ABC specifications proposed by the Council for the 1998 fishing year, therefore, are based on the best available scientific information, including projected biomass trends, information on assumed distribution of stock biomass, and revised technical methods used to calculate stock biomass. The TAC specifications (Tables 1 and 2), once implemented by the Secretary, define upper harvest limits, or fishery removals, during the 1998 fishing year. Absent Secretarial approval within the first quarter of calendar year 1998, directed fishing in excess of the interim TAC specification is unauthorized.

2.0 ALTERNATIVES INCLUDING PROPOSED ACTION

Alternative 1 - Implement, in 1998, TAC specifications that are equivalent to the 1997 TAC specifications.

Under this alternative, the sums of the BSAI and GOA TAC specifications in 1998 would be the same as those specified for the 1997 groundfish fisheries in the BSAI and GOA. TAC, ABC and OFL levels for this alternative are shown in Tables 1 and 2 as the 1997 specifications.

Alternative 2: Implement the proposed 1998 TAC specifications.

Under this alternative, the BSAI and GOA TAC specifications are adjusted to include updated surveys and new calculations of ABC and OFL by the Plan Teams and recommended by the Council at its November and December 1997 meetings. Proposed TAC, ABC and OFL levels for this alternative are shown in Tables 1 and 2 as the 1998 proposed specifications.

3.0 ENVIRONMENTAL CONSEQUENCES

An EA is required by NEPA to determine whether the action considered will result in significant effects on the human environment. If the environmental effects of the action are determined not to be significant based on an analysis of relevant considerations, the EA and resulting finding of no significant impact would be the final environmental documents required by NEPA. If this analysis concludes that the proposal is a major Federal action significantly affecting the human environment, an environmental impact statement must be prepared.

An EA must include a brief discussion of the need for the proposal, alternatives to the proposal, the environmental impacts of the proposed action, and a list of agencies and persons consulted. The purpose and needs are discussed in Sections 1. A description of the alternatives is in Section 2. Section 6 contains the list of agencies and persons consulted. This section contains the discussion of the environmental impacts including impacts on threatened and endangered species and marine mammals.

The environmental impacts generally associated with fishery management actions are effects resulting from: (1) Harvest of fish stocks that may result in changes in food availability to predators, changes in population structure of target fish stocks, and changes in community structure; (2) changes in the physical and biological structure of the benthic environment as a result of fishing practices (e.g., gear effects and fish processing discards); (3) entanglement/entrapment of non-target organisms in active or inactive fishing gear; and (4) major shifts in the abundance and composition of the marine community as result of disproportionate fishing pressure on a small set of species (also known as "cascading effects" National Research Council 1996).

3.1 Overview of Status

The status of each target species category, biomass estimates, and ABC specification are presented both in summary and in detail in the GOA and BSAI SAFE reports (NPFMC 1997a; b). This EA addresses significant changes between the 1997 TAC specifications and the Council recommended 1998 TAC specifications and provides relevant socioeconomic information.

Four categories of species are likely to be taken in the GOA and BSAI groundfish fisheries: (1) Prohibited species--those species and species groups the catch of which must be returned to the sea with a minimum of injury except when their retention is authorized by other applicable law; (2) target species--those commercially important species for which sufficient data exists to allow each to be managed on its own biological merits; (3) other species--those species and species groups currently of slight economic value and not generally targeted for harvest; and (4) nonspecified species--those species and species groups generally of no current economic value taken by the groundfish fishery in Federal waters only as incidental catch.

3.1.1 Status of Groundfish Target Species

For the target species, the Council may split or combine species groups for purposes of establishing individual TAC specifications based on commercial importance of a species or species group and whether sufficient biological information is available to manage a species or species group on its own biological merits.

Designated target species and species groups in the BSAI are walleye pollock, Pacific cod, yellowfin sole, Greenland turbot, arrowtooth flounder, rock sole, other flatfish, flathead sole, sablefish, Pacific ocean perch, other rockfish, Atka mackerel, and squid and other species. Differences between 1997 and 1998 for the BSAI area are presented in Table 1 and discussed in section 3.1.1.1.

Designated target species and species groups in the GOA are walleye pollock, Pacific cod, deep water flatfish, rex sole, shallow-water flatfish, flathead sole, arrowtooth flounder, sablefish, other slope rockfish, northern rockfish, Pacific Ocean Perch, shortraker and rougheye rockfish, pelagic shelf rockfish, demersal shelf rockfish, Atka mackerel, thornyhead rockfish, and other species. Differences between 1997 and 1998 for the GOA are presented in Table 2 and discussed in section 3.1.1.2.

Walleye pollock is a semidemersal schooling fish that is widely distributed throughout the North Pacific in temperate and subarctic waters. In the GOA, major exploitable concentrations are found primarily in the Central and Western regulatory areas. Stock structure in the BSAI is not well defined. Three stocks are considered to exist for management purposes: an eastern Bering Sea, an Aleutian Island and a Bogoslof Island stock. Pollock in the GOA are managed as a single stock (Alton and Megrey 1986). Major spawning concentrations of pollock in the GOA have been observed in Shelikof Strait and the Shumagin Islands. Pollock stocks in the eastern Bering Sea and Shelikof Strait are surveyed annually using echo integration trawl (EIT) survey techniques and triennially using bottom trawls in the GOA. The eastern Bering Sea shelf is surveyed annually with bottom trawls.

Pacific cod occurs on the continental shelf and upper slope from Santa Monica Bay, California through the GOA, Aleutian Islands, and eastern Bering Sea to Norton Sound (Bakkala *et al.* 1981). It has been suggested that Gulf of Alaska, Bering Sea, and Aleutian Islands cod stocks are genetically indistinguishable (Grant *et al.* 1987), and tagging studies show that cod move between the Bering Sea and the Gulf of Alaska (Shimada and Kimura 1994). Since the magnitude and regularity of such migrations are unknown, Pacific cod is managed separately in the GOA and the BSAI. The Pacific cod stock is exploited by a multiple-gear fishery that includes trawl, longline, pot and jig components. Based on estimates from the stock synthesis catch at age model, stock size appears to be declining in both the BSAI and GOA.

Flathead sole is distributed from northern California northward throughout Alaska. In the northern part of its range, it overlaps with the related and very similar Bering flounder. Because it is difficult to separate these two species at sea, they are managed as a single stock. Flathead sole are usually taken in target fisheries for other species. Biomass estimates from the Bering Sea shelf and Aleutian Islands trawl survey indicate that the stock abundance has been stable since 1990. Flathead sole receive a separate ABC and TAC in both the Gulf and the BSAI. However, in the BSAI, they are managed in the same prohibited species catch (PSC) classification as rock sole and other flatfish and receive the same PSC allowances.

Rock sole is distributed from southern California northward through Alaska. Two species of rock sole occur in the North Pacific ocean. The distribution of the species overlap in the GOA while the northern species dominates the BSAI. Rock sole are important as the target of a high value roe fishery occurring in February and March, which accounts for the majority of the BSAI catch. Commercial harvest occurs primarily on the eastern Bering Sea continental shelf and in lesser amounts in the Aleutian Islands region. Biomass estimates from the Bering Sea shelf and Aleutian Islands trawl survey indicate an increasing population. In the BSAI, rock sole receive a separate ABC and TAC, while in the GOA, they are managed as part of the "shallow-water flatfish" species complex.

Greenland turbot is distributed from Baja California northward throughout Alaska. It is rare south of Alaska and is primarily distributed in the eastern BSAI region. Juveniles are believed to spend the first three or four years of life on the continental shelf and then move to the continental slope. Juveniles are absent in the Aleutian Islands region, suggesting that populations in that area originate from elsewhere. The biomass of Greenland turbot in the BSAI increased markedly during the 1970s and is currently estimated to be about half of the unfished level. However, there has been a lack of recruitment success during recent years that has led to extra caution in setting harvest levels. Greenland turbot is a relatively valuable species. However, because of low ABC and TAC amounts it is primarily a bycatch only fishery. In the BSAI Greenland turbot receive a separate ABC and TAC, while in the GOA, they are managed as part of the "deep-water flatfish" species complex.

Yellowfin sole is distributed throughout the Bering Sea where it is one of the most abundant flatfish species and is the target of the largest flatfish fishery in the United States. While also found in the Aleutian Islands and GOA, the stock is of negligible size in those areas. Yellowfin sole stocks were over exploited by foreign fisheries in 1959-1962. Since that time, indices of relative abundance have shown major increases in abundance during the late 1970s. Since 1981, abundance has fluctuated widely but biomass estimates indicate that the yellowfin sole population remains at a high, stable level. In the GOA, yellowfin sole are managed as part of the "shallow-water flatfish" species complex.

Arrowtooth flounder is common from Oregon through the eastern Bering Sea. The very similar Kamchatka flounder also occurs in the Bering Sea, and because it is not usually distinguished from arrowtooth flounder in commercial catches, both species are managed as a group. Arrowtooth flounder is a relatively large flatfish that occupies continental shelf waters almost exclusively until age 4, but at older ages occupies both shelf and slope waters. The species has a low perceived commercial value and is primarily taken as bycatch in other high value fisheries. Stocks are lightly exploited and appear to be increasing in both the GOA and the BSAI.

Other flatfish in the GOA are managed as two groups: "deep-water flatfish" (Dover sole, Greenland turbot and deepsea sole) and "shallow-water flatfish" (primarily rock sole, butter sole and starry flounder). Flatfish were separated into two groups in 1990 because of significant differences in halibut bycatch rates in directed fisheries targeting on shallow and deep water flatfish species. Rex sole was split out of the deep water assemblage in 1993 because of concerns regarding the Pacific ocean perch bycatch in the rex sole target fishery. The principal source of information for evaluating the condition of other flatfish stocks in the GOA is the triennial bottom trawl survey.

In the BSAI, other flatfish are managed as a unit. The group is dominated by Alaska plaice, which accounts for over 80 percent of the landings from this group. Other species in the group include rex sole, Dover sole and starry flounder. These stocks have been lightly harvested and are primarily taken as bycatch in other fisheries. In recent years Alaskan plaice has become a more important target species, and increasing amounts are being retained. The principal source of information for evaluating the condition of other flatfish stocks in the BSAI is the annual eastern Bering Sea trawl survey.

Sablefish in the northeastern Pacific Ocean extends from northern Mexico to the GOA, westward to the Aleutian Islands, and into the Bering Sea. Substantial movement between the Bering Sea-Aleutian Islands and the GOA has been documented (Heifetz and Fujioka 1991), thus sablefish in Alaskan waters are considered one stock and assessed in a combined area model. However, in order to distribute effort, the TAC is allocated to eight discreet regions. Relative abundance is estimated by annual longline surveys in the GOA. The longline survey also samples the Aleutian Islands in even-numbered years, and the Bering Sea in odd numbered years. These surveys indicate that the stock size peaked in the mid 1980s and has been declining since.

Pacific ocean perch inhabit the outer continental shelf and slope regions of the North Pacific and Bering sea and are the most commercially important rockfish in Alaska's fisheries. Pacific ocean perch are highly valued and supported large Japanese and Soviet trawl fisheries throughout the 1960s. Apparently, stocks were not productive enough to support the large removals that took place, and they declined throughout the 1960s and 1970s, reaching their lowest levels in the early 1980s. Since that time, stocks have stabilized in the eastern Bering Sea, and increased in the Aleutian Islands and GOA. Bottom trawls have accounted for nearly all commercial harvest of Pacific ocean perch.

Northern rockfish also inhabit the outer continental shelf and are caught by bottom trawls, but are usually found in shallower depths than Pacific ocean perch. Although northern rockfish are lower in value than Pacific ocean perch, they still support a valuable directed trawl fishery, especially in the GOA. Previously, northern rockfish were managed as part of the "other slope rockfish" category in the GOA; since 1993, however, they have been separated from this group and assigned their own ABC and TAC to prevent their possible overfishing. In the Aleutian Islands, northern rockfish are grouped together with sharpchin rockfish for management purposes, but sharpchin rockfish are so rare in this region that the group is essentially just northern rockfish. The catch of northern rockfish in the Aleutian Islands is relatively large, but, in contrast to the GOA, much of it appears to come from by-catch.

Shortraker and rougheye rockfish historically have been taken by bottom trawls in areas of steep topography along the continental slope, typically in deeper water than Pacific ocean perch. In recent years, however, a sizeable percentage of the shortraker/rougheye catch has been taken by longlines, generally incidental to the sablefish and halibut fisheries. Although shortraker/rougheye are highly valued, amounts available to the commercial fisheries are limited by relatively small TAC and ABC amounts that are fully needed to support bycatch needs in other groundfish fisheries. As a result, the directed fishery for these species typically is closed at the beginning of the fishing year. Nonetheless, bycatch amounts can exceed TAC and approach the overfishing level. Harvest of shortraker and rougheye rockfish exceeded TAC in the eastern area of the GOA in 1997. In the Aleutian Islands area during 1997, the shortraker/rougheye bycatch in the Pacific ocean perch and Atka mackerel trawl fisheries (778 mt and 162 mt, respectively) exceeded the acceptable biological catch and caused overfishing concerns. This resulted in the closure of these and other trawl fisheries in the Aleutian Islands, as well as the hook-and-line gear fisheries for Pacific cod and Greenland turbot. The individual fishery quota fisheries for sablefish and halibut were threatened by the possibility of closure as well. For this reason, the Council has recommended the establishment of separate Shortraker/rougheye maximum retainable bycatch percentages in the Aleutian Islands in order to discourage harvest of these species.

Other rockfish species (GOA) At least 25 other rockfish species of the genus *Sebastes* have been reported to occur in the GOA

(Eschmeyer *et al.* 1983), and several of these are also of commercial importance. These other rockfish are managed as three groups: "other slope rockfish", "demersal shelf rockfish" and "pelagic shelf rockfish". The "other slope rockfish" group consists of 17 species that, as adults, inhabit the outer continental shelf and continental slope, generally in depths greater than 150-200 m. Many of the species in this group, such as harlequin and sharpchin rockfish, are small and of lower economic value. The "demersal shelf rockfish" group is only recognized as a management group in the southeast outside district of the GOA. It consists of seven species and is dominated by yelloweye rockfish, which accounts for 90 percent of all demersal shelf rockfish landings. Though the Council sets ABCs and TACs for demersal shelf rockfish, the group is managed by the State of Alaska. The "pelagic shelf rockfish" group consists of five species that inhabit waters of the continental shelf and typically exhibit a midwater, schooling behavior. Some species, however, can be taken with bottom trawls, and one (dusky rockfish) is the target of a moderately valuable trawl fishery on the outer continental shelf. Black rockfish are also taken by commercial jig fishermen from inshore reefs and kelp beds. Nearshore (black rockfish and blue rockfish) and offshore (dusky, widow and yellowtail rockfish) components of this group are recognized and separate ABCs and TACs are established for each subgroup in the central GOA. Amendment 46 was approved by NMFS on February 3, 1998. This amendment removes nearshore pelagic shelf rockfish from the FMP and transfers management authority to the State of Alaska.

<u>Other rockfish species (BSAI)</u> Over 27 other rockfish species have been confirmed or tentatively identified in catches from the BSAI. Shortspine thornyheads, however, account for the bulk of other rockfish catch. Based on recent trawl survey results from the Aleutian Islands, over 90 percent of the other rockfish biomass is composed of shortspine thornyheads. Estimates of other rockfish abundance are characterized by extremely wide variances and trends in stock size are not apparent.

<u>Atka mackerel</u> are distributed from the east coast of the Kamchatka peninsula, throughout the Aleutian Islands and the eastern Bering Sea, and eastward through the GOA to southeast Alaska. They are an important prey species for marine mammals and are the target of a directed trawl fishery. Atka mackerel is a difficult species to survey because they do not have a swim bladder, which makes them a poor target for hydroacoustic surveys. They prefer rough and rocky bottoms that are difficult to trawl, and their schooling behavior makes the species susceptible to large variances in catches. Because of this, it has not been possible to estimate trends in population for the species except in the Aleutian Islands where the species is most commonly encountered. In this area, biomass estimates for Atka mackerel have declined to approximately half of their 1991 level.

In the GOA, Atka mackerel have been managed as bycatch only fisheries.

3.1.1.1 Update of target species stock status of groups in the BSAI.

Walleye pollock determination of the 1998 ABC for the eastern Bering Sea was based on two age-structured population dynamics models; a traditional cohort analysis model and a statistical age structured model (SAM), which was introduced last year. Similar, but less extensive, models were used to determine ABC for the Aleutian Islands. The 1998 assessments incorporated catch data from the 1996 fisheries as well as biomass and age composition estimates from the 1997 eastern BSAI bottom trawl surveys and eastern Bering Sea and Bogoslof district EIT surveys.

Pacific cod new data from the 1996 and 1997 commercial fisheries and the 1997 eastern Bering Sea bottom trawl survey were incorporated into the assessment model, and size composition data from trawl catches sampled on shore were removed. The projected age 3+ biomass for the eastern Bering Sea and Aleutians was down about 16 percent from last years projection for biomass in 1997. This resulted in lower OFL and ABCs for 1998.

Table 1. Council recommended total allowable catch specifications for the Bering Sea and Aleutian Islands management area. 1997 ABC, and actual catch through November 14, 1997; and 1998 proposed ABC, OFL, and TAC specifications.

Species	1997 Specifications				1998 Specifications		
	Area	ABC	TAC	Actual Catch	ABC	TAC	OFL
Pollock	Bering Sea (BS)	1,130,000	1,130,000	1,034,645	1,110,000	1,110,000	2,060,000
	Aleutian Is. (AI)	28,000	28,000	24,758	23,800	23,800	31,700
	Bogoslof District	32,100	1,000	202	6,410	1,000	8,750
Pacific cod	BSAI	306,000	270,000	237,845	210,000	210,000	336,000
Sablefish	BS	1,308	1,100	547	1,300	1,300	2,160
	AI	1,367	1,200	785	1,380	1,380	2,230
Atka mackerel	Total	66,700	66,700		64,300	64,300	134,000
	Western AI	32,200	32,200	29,540	27,000	27,000	....
	Central AI	19,500	19,500	19,990	22,400	22,400	....
	Eastern AI/BS	15,000	15,000	16,310	14,900	14,900	....
Yellowfin sole	BSAI	233,000	230,000	171,169	220,000	220,000	314,000
Rock sole	BSAI	296,000	97,185	67,564	312,000	100,000	449,000
Greenland turbot	Total	12,350	9,000		15,000	15,000	22,300
	BS	8,275	6,030	6,610	....	10,050	....
	AI	4,075	2,970	1,079	....	4,950	....
Arrowtooth flounder	BSAI	108,000	20,760	9,748	147,000	16,000	230,000
Flathead sole	BSAI	101,000	43,500	20,420	132,000	100,000	190,000
Other flatfish	BSAI	97,500	50,750	22,380	164,000	89,434	253,000
Pacific ocean perch	BS	2,800	2,800	827	1,400	1,400	3,300
	AI Total	12,800	12,800		12,100	12,100	20,700
	Western AI	6,390	6,390	6,866	5,580	5,580	....
	Central AI	3,170	3,170	2,795	3,450	3,450	....
	Eastern AI	3,240	3,240	2,987	3,070	3,070	....
Other red rockfish	BS	1,050	1,050	233	267	267	356
Sharpchin/Nrthrn.	AI	4,360	4,360	1,997	4,230	4,230	5,640
Shortrkr./rougheye	AI	938	938	1,045	965	965	1,290
Other rockfish	BS	373	373	162	369	369	492
	AI	714	714	307	685	685	913
Squid	BSAI	1,970	1,970	1,769	1,970	1,970	2,620
Other species	BSAI	25,800	25,800	23,048	25,800	25,800	134,000
TOTAL		2,464,130	2,000,000	1,705,628	2,454,976	2,000,000	4,202,451

Table 2. Council recommended total allowable catch specifications for the Gulf of Alaska management area. 1997 ABC, TAC specifications and actual catch through November 14, 1997; and 1998 plan team proposed ABCs.

Species	1997 Specifications				1998 Specifications		
	Area	ABC	TAC	Actual Catch	ABC	TAC	OFL
Pollock	Shumagin (610)	18,600	18,600	26,625	29,790	29,790	
	Chirikof (620)	31,250	31,250	32,005	50,045	50,045	
	Kodiak (630)	24,550	24,550	24,778	39,315	39,315	
	W/C						170,500
	E	5,580	5,580	5,906	10,850	5,580	15,600
Pacific Cod**	W	28,500	24,225	24,034	27,260	21,810	
	C	51,400	43,690	43,416	49,080	40,490	
	E	1,600	1,200	780	1,560	1,170	
	Gulf wide						141,000
Flatfish, Deep Water	W	340	340	14	340	340	
	C	3,690	3,690	2,586	3,690	3,690	
	E	3,140	3,140	578	3,140	3,140	
	Gulf wide						9,440
Rex Sole	W	1,190	1,190	686	1,190	1,190	
	C	5,490	5,490	2,336	5,490	5,490	
	E	2,470	2,470	148	2,470	2,470	
	Gulf wide						11,920
Flatfish, Shallow Water	W	22,570	4,500	470	22,570	4,500	
	C	19,260	12,950	6,781	19,260	12,950	
	E	1,320	1,180	49	1,320	1,180	
	Gulf wide						59,540
Flathead Sole	W	8,440	2,000	459	8,440	2,000	
	C	15,630	5,000	1,853	15,630	5,000	
	E	2,040	2,040	59	2,040	2,040	
	Gulf wide						34,010
Arrowtooth	W	31,340	5,000	2,780	33,010	5,000	
	C	142,100	25,000	11,710	149,640	25,000	
	E	24,400	5,000	879	25,690	5,000	
	Gulf wide						295,970
Sablefish	W	1,860	1,860	1,368	1,840	1,840	
	C	6,410	6,410	6,149	6,320	6,320	
	E	6,250	6,250	5,447	5,960	5,960	
	Gulf wide						23,450
Rockfish, Other Slope	W	20	20	70	20	20	
	C	650	650	935	650	650	
	E	4,590	1,500	202	4,590	1,500	
	Gulf wide						7,560
Rockfish, Northern	W	840	840	68	840	840	
	C	4,150	4,150	2,861	4,150	4,150	
	E	10	10	15	10	10	
	Gulf wide						9,420

Table 2 (continued). Council recommended total allowable catch specifications for the Gulf of Alaska management area. 1997 ABC, OFL, TAC specifications and actual catch through November 14, 1997; and 1997 proposed ABC, OFL, and TAC specifications.

Species	1997 Specifications				1998 Plan Team Proposed Specifications		
	Area	ABC	TAC	Actual Catch	ABC	TAC	OFL
Pacific Ocean	W	1,840	1,472	1,834	1,810	1,810	
Perch	C	6,690	5,352	6,702	6,600	6,600	
	E	4,460	2,366	970	4,410	2,366	
	Gulf wide						18,090
Shortraker/	W	160	160	138	160	160	
Rougheye	C	970	970	925	970	970	
	E	460	460	536	460	460	
	Gulfwide						2,740
Rockfish,	W	570	570	108	550	550	
Pelagic Shelf	C	3,320	3,320	1,767	3,380	3,380	
	E	990	990	566	1,070	1,070	
	Gulfwide						8,040
Rockfish, Demersal Shelf	SEO	950	950	348	560	560	950
Atka Mackerel	Gulfwide	1,000	1,000	331	600	600	6,200
Thornyhead	W				250	250	
	C				710	710	
	E				1,040	1,040	
	Gulfwide	1700	1700	1209			2840
Other Species	Gulfwide		13,470	5,022	NA	15,450	
TOTAL		492,790	282,555	226,503	548,770	324,456	817,270

Sablefish are assessed using a combined area model for both the GOA and the BSAI. Relative abundance and length data were obtained from the 1997 sablefish longline survey of the eastern Bering Sea and GOA. The abundance index decreased 6.2 percent in numbers and 12.1 percent in weight from 1996 to 1997 following a decrease of 0.3 percent in numbers and increase of 8.8 percent in weight from 1995 to 1996. The 1997 catch rate of fish around 50-53 cm fork length was greater than usual, representing recruitment of the 1995 year class into the population. It takes three years' sightings of a year class to include it in the model. The population is decreasing from a peak in the mid-1980s. The peak occurred due to strong recruitment in the late 1970s which has decreased in recent years. If recent low recruitment levels continue, the population is projected to continue to decrease and the harvestable amount will result in yields of 16,000 mt within three years.

Atka mackerel status is assessed using a stock synthesis model that is designed to incorporate diverse auxiliary information. Because of difficulties in surveying Atka mackerel populations, this is appropriate. New data from the 1997 triennial Aleutian bottom trawl survey and the 1996 fishery were added to the model. Determination of ABC was based on the use of a 1997 harvest rate of 12 percent.

Yellowfin sole data from the 1996 fishery and the 1997 trawl survey were incorporated into the model used to assess stock status. Because it was possible to estimate female spawning biomass, the overfishing level and ABC were determined based on tier 3A of the overfishing definitions.

Rock sole data from the 1996 fishery and the 1997 trawl survey were incorporated into the model used to assess stock status. Because it was possible to estimate female spawning biomass, the overfishing level and ABC were determined based on tier 3A of the overfishing definitions.

Pacific ocean perch harvest data from 1997 and data from the Aleutian Islands triennial trawl survey were included in the assessment. A new stock synthesis model was employed that de-emphasized the trawl survey and fishery size composition likelihood components of the model; collapsed the trawl survey biomass estimates into a single point estimate; and used the model to estimate the catchability coefficient rather than fixing its value at 1.0. The new model fits better than in past years. The 1997 triennial survey used a new methodology, in which 15 minute, rather than 30 minute net-tows were used. Because of difficulties comparing this survey with past surveys, the recommended ABC was conservative.

Greenland turbot new estimates of retained and discarded Greenland turbot from other target fisheries were provided and estimated catch levels from recent years were updated. As in past years, populations were assessed using a stock synthesis model, though the length-weight relationship used by the model was recalibrated and data from the 1997 eastern Bering Sea shelf survey were included.

Arrowtooth flounder the results of the 1997 Bering Sea shelf trawl survey were include in the model used to estimate the current biomass trend and size composition of the shelf portion of the stock. The assessment model was changed to more closely fit the results of the time-series of Bering Sea shelf biomass estimates. This resulted in population estimates 25 percent to 30 percent higher than those from last years model. A new length based synthesis model was used to provide revised estimates of exploitable biomass, survey selectivity and ABC. Because it was possible to estimate female spawning biomass, tier 3A of the overfishing definitions was used to determine ABCs.

Flathead sole the results of the 1997 trawl survey and data from the 1997 fishery were incorporated into the assessment. The relationship between the current estimated biomass and maximum sustainable yield are not known for flathead sole stocks in the BSAI. However, reliable estimates of biomass and the overfishing level exist. Based on the stipulations of Amendment 44, Tier 4 is used to calculate overfishing and ABC.

Other flatfish the 1997 catch and 1997 Aleutian Islands and Bering Sea survey biomass estimates were incorporated into the assessment. For the Alaska plaice assessment, annual age compositions were only included for estimates that were derived from an age-length key where age structures were collected during the same year. New natural mortality values were evaluated in the model. These changes resulted in higher projections of biomass and recruitment throughout the time series as well as a higher recommended ABC.

Squid and other species new catch data were added to the assessment. Because of a lack of data on squid population dynamics and current biomass, the overfishing level was set equal to the average annual catch from 1978-1995. The ABC was set at 75 percent of the overfishing level (Tier 6 of the overfishing definitions). Biomass estimates for many of the species groups that comprise the other species category are reliable, and a conservative estimate of mortality can be made, suggesting that tier 5 of the overfishing definitions could be used to determine the ABC. This would result in an ABC approximately five times higher than in past years. A compelling reason to change the other species assessment does not exist at this time. Thus, as in previous assessments, the ABC was set equal to the average catch since 1978.

3.1.1.2 Update of target species stock status of groups in the GOA.

Walleye pollock determination of ABC used the natural mortality (M) coefficient of .3 for age class two and up, though the stock assessment team is exploring a new model that would incorporate a relative predation mortality estimate, by year class from age one, for pollock's main predators (arrowtooth flounder, Pacific halibut and Steller sea lions). As in 1997, the information used included length-frequency data from the 1996 hydroacoustic survey, age composition data from the 1996 fisheries, updated estimates of discard and catch, and correction factors to account for catchability in bottom trawl surveys. The 1998 fishery is heavily dependent on the 1994 year class. Spawn from 1995, 1996, and 1997 do not appear to be resulting in strong year classes. The stock synthesis catch at age model predicted a beginning year +2 biomass in 1998 as 1,255,000 t., higher than the hindcast 1997 biomass of 1,046,000 t. The bulk of the pollock harvest in the western gulf occurs in locations defined as Steller sea lion critical habitat.

Pacific cod management in 1997 incorporated a State of Alaska inshore fishery on Pacific cod separately from the federally authorized fishery. Size composition data from trawl catches sampled on shore were removed from the biomass model. Length-frequency and catch data from the inshore fishery were incorporated into the assessment. The projected 1998 total age 3+ biomass is up about six percent from the 1997 projection. The risk-averse optimum ABC for 1998 is 77,900 t, down about four percent from last year's recommendation for 1997.

Flatfish Deep water flatfish includes three species: dover sole Greenland turbot, and deep-sea sole. Average catches are used to calculate ABC and OFL because the trawl survey does not sample deep water where these species occur. Natural mortality values of 0.2 were used for all flatfish except 0.10 was used for Dover sole. Due to the overlapping distributions of flatfish species, it is not possible to target a species within an arbitrary management group without impacting other flatfish species in that group or other species which are managed separately. Some species, therefore, may be subjected to higher fishing mortalities than that resulting from the recommended ABCs. Even the most abundant species of the shallow-water category, rock sole, could be over-harvested given the present species grouping. The 1996 flatfish fishery harvested about 19 percent of the ABC, which was up from 13 percent in 1995, excluding arrowtooth flounder, and is likely to continue to be limited by the potential for high by-catches of Pacific halibut.

Arrowtooth flounder stock assessments were given separate consideration from Alaska flatfish in the GOA beginning in 1997 to reflect single species management rather than species group management. Current biomass for arrowtooth flounder in the GOA is estimated to be greater than the long-term average biomass that would be expected under average recruitment and fishing mortality. Harvest of arrowtooth is considerably less than the available ABC because the market for the product is limited.

Though the market has increased in recent years, the ABC remains underutilized. Predation by arrowtooth flounder may be controlling the invertebrate component of the ecosystem.

Sablefish relative abundance and length data were obtained from the 1997 sablefish longline survey of the eastern Bering Sea and GOA. The abundance index decreased 6.2 percent in numbers and 12.1 percent in weight from 1996 to 1997 following a decrease of 0.3 percent in numbers and increase of 8.8 percent in weight from 1995 to 1996. The 1997 catch rate of fish around 50-53 cm fork length was greater than usual, representing recruitment of the 1995 year class in the population. It takes three year's sightings of a year class to include it in the model. The population is decreasing from a peak in the mid-1980s. The peak occurred due to strong recruitment in the late 1970s which has decreased in recent years. If recent low recruitment levels continue, the population is projected to continue to decrease and the harvestable amount will result in yields of 16,000 mt within three years.

Slope rockfish The 1996 trawl survey indicated that Pacific ocean perch was by far the most abundant species in the slope rockfish assemblage. Other slope species caught in descending order of Gulfwide biomass included: northern, sharpchin, rougheye, silvergrey, shortraker, harlequin, and redstripe rockfish. Longline surveys of the continental slope also provide data on the relative abundance of shortraker and rougheye rockfish. Because of the uncertainty concerning the biomass estimates for slope rockfish based on the surveys, a weighted average of the three most recent surveys, 1990, 1993, and 1996 (in which the more recent surveys are given progressively greater weight) is used to determine exploitable biomass for all species except Pacific ocean perch.

Pelagic Shelf Rockfish The Council has approved Amendment 46 to the Gulf FMP. This Amendment would remove black and blue rockfish from the FMP and transfer management authority to the State of Alaska. Because approval of Amendment 46 is still pending, an ABC recommendation is being made for the nearshore component of the pelagic shelf rockfish management group (black and blue rockfish). Because approval of Amendment 46 is anticipated, the Gulfwide exploitable biomass for the group was recalculated excluding the nearshore component in the central area. Stock condition of the offshore component is assessed by the triennial bottom trawl survey and similar to slope rockfish, exploitable biomass is determined by a weighted average of the three most recent surveys. This survey last took place in 1996, so no new stock information exists for this year.

Demersal shelf rockfish port samples from 1995 and 1996 were used to update growth parameters, which resulted in new estimates of overfishing. Also, new data from the 1997 line transect survey for the central south east outside district and the east Yakutat district were incorporated into the assessment.

Densities of demersal shelf rockfish were estimated to be lower in both areas than in 1995. The decrease is primarily due to reduced habitat area estimation used in the new model. This, coupled with new methods for estimating biomass in the east Yakutat area, resulted in significantly lower ABC recommendations.

Thornyhead rockfish updated estimated catch levels, revised relative population estimates from the longline survey (1990-1997) and length composition estimates from the 1996-1997 fishery were incorporated into the assessment. Last year, a size based, age-structured model was developed. The model used this year to estimate ABC and overfishing levels was fairly similar, though slightly different model assumptions were used. The recommended 1998 ABC was 11 percent higher than for last year, primarily because of changes in the way natural mortality was estimated and the different approach to modeling.

Atka mackerel there was no reliable estimate of current biomass from the last (1996) triennial trawl survey and average catch from 1978-1995 was used to determine overfishing levels. Based on Tier 6 of the overfishing definitions, ABC should be set at 75 percent of OFL. However, Leslie estimates of local population sizes suggest that abundance has declined significantly in localized areas from 1992 to 1994 and Atka mackerel has exhibited vulnerability to fishing pressures in the past. Thus, the ABC was set at a lower level sufficient only to satisfy anticipated bycatch needs for other trawl fisheries.

3.1.2 Status of Higher Trophic Level Species

Higher trophic level species present in the fishing areas include marine mammals, birds, and many target and nontarget species of fish. The status of these populations is determined at any given time by a combination of temporal and spacial factors played out over many years. Any meaningful analysis of status requires recognition that continual change in size and importance of any given population is the operative norm. Status discussions have limited utility dependant on the window of time in which they are viewed and recognition of forces bringing about population shifts. Attempting to analyze population changes annually is problematic because change may be occurring slowly and may be lagging years behind the causes.

3.1.2.1 Status of Marine Mammal Pinniped Species

Pinniped species that interact with groundfish fisheries either in the fisheries themselves through potential entanglements/ entrapments and possibly mortalities, or through competition for prey directly or indirectly, are Steller sea lion, northern fur seal, harbor seal, spotted seal, bearded seal, ringed seal, and ribbon seal. New information on predator-prey relationships, the population status, and management actions concerning these species is summarized below.

Steller Sea Lions range along the North Pacific Ocean rim from northern Japan to California (Loughlin *et al.* 1984), with centers of abundance and distribution in the GOA and Aleutian Islands, respectively.

NMFS has the authority to implement regulations necessary to protect Steller sea lions under the ESA and MMPA. Similarly, under the Magnuson-Stevens Act, NMFS has the authority to regulate fishing activities that may be affecting sea lions, directly or indirectly. In 1990, coincident with the ESA listing of Steller sea lion, NMFS: (1) Prohibited entry within three nm of listed Steller sea lion rookeries west of 150° W. long.; (2) prohibited shooting at or near Steller sea lions; and (3) reduced the allowable level of take incidental to commercial fisheries in Alaskan waters (50 CFR 227.12) (Fritz *et al.* 1995). As a result of ESA section 7 consultations on the effects of the North Pacific federally-managed groundfish fisheries, NMFS implemented additional protective measures in 1991, 1992, and 1993 to reduce the effects of certain commercial groundfish fisheries on Steller sea lion foraging [50 CFR 679.20(a)(5)(ii), 679.22(a)(7) and (a)(8), and 679.22(b)(2))(1994)]. Effective 4 June 1997, NMFS separated the Steller sea lion population into eastern and western stocks and listed the western stock as endangered under the ESA (62 FR 24345). The eastern stock remains listed as threatened. The two stocks are separated at 144°W, or approximately at Cape Suckling, just east of Prince William Sound. This stock separation was based on genetic differences (mitochondrial DNA), different population trajectories (declining stock in the west, stable or slightly increasing stock in the east), as well as other factors. No additional management actions accompanied the 1997 change in ESA listing. Because Steller sea lions are long lived with slow reproductive rates, the effects, if any, of these above listed regulatory mechanisms and protective regulations on the Steller sea lion population may be slow to manifest themselves. For perspective, NMFS marine mammal managers estimate that fish harvest regulations may need to be in place a minimum of 10 years to observe effects in the population.

An Alaska-wide aerial survey for Steller sea lions was not scheduled for 1997 (beginning in 1992, aerial surveys have been on an alternate-year schedule). However, the NMFS did conduct a partial survey during 10-14 June, 1997, which covered the central and western GOA and the eastern Aleutians Islands. Specifically, the 1997 survey included rookery and haul-out sites from Outer Island off the Kenai Peninsula to the Umnak Island region. Protocols and methods were the same as for the June 1996 aerial surveys. Numbers of non-pups at rookery and haul-out trend sites in the three-region area declined by 13.9 percent since 1994 and 10.3 percent since June 1996 (NPFMC 1997c). The greatest relative declines were in the central GOA (Kenai Peninsula to the Semidi Islands), a region where non-pup numbers have declined each survey since 1989. Numbers also declined at trend sites in the western GOA and in the eastern

Aleutian Islands, two regions where numbers had been stable or increasing since 1989. Considering all sites surveyed each year since 1994 (approximately 50 percent more animals than at trend sites only), numbers of non-pups remained stable in the western Gulf and eastern Aleutian Islands (10,858 in 1994, 11,034 in 1996, 11,080 in 1997).

The NMFS and Alaska Department of Fish and Game (ADFG) also counted sea lion pups at 14 rookeries during June-July 1997. The four rookeries on Attu, Agattu, and Buldir islands in the western Aleutians had not been counted previously by NMFS, thus no comparable data for analysis exist. In the central Aleutians, pup numbers increased by 25 percent at Kasatochi since the last count in 1994; the increase at Sequam-Saddleridge was equivocal. Pup counts on Bogoslof and Ugamak Islands in the eastern Aleutians are essentially unchanged from 1994/1995 to 1997, although the count at Ugamak Island in 1996 was greater by more than 100 pups. Numbers of pups at Forrester Island have been stable for several years. Pup numbers at the two other rookeries in southeast Alaska, and for southeast Alaska in general, continue to increase.

NMFS observers monitored incidental take on the BSAI and GOA groundfish trawl, longline, and pot fisheries during 1990-1995. Observed incidental mortality occurred in the BSAI groundfish trawl fishery with a mean annual (total) mortality of 12, GOA groundfish trawl fishery was 1.2, Bering Sea groundfish longline fishery 0.2, and GOA groundfish longline fishery 1.0. No sea lion mortality was observed by NMFS in either pot fisheries (Hill *et al.* 1997).

<u>Northern fur seals</u> The range of the northern fur seals is throughout the North Pacific Ocean, however, they only breed at a few sites (Commander, Bogoslof and Pribilof Islands in the southern Bering Sea). During the breeding season, approximately 74 percent of the worldwide population is found on the Pribilof Islands with the remaining animals spread throughout the North Pacific Ocean. Of the seals in U.S. waters outside of the Pribilofs, approximately one percent of the population is found on Bogoslof Island in the southern Bering Sea and San Miguel Island off southern California (NMFS 1993). Two separate stocks of northern fur seals are recognized within U.S. waters: An Eastern Pacific stock and a San Miguel Island stock. The most recent estimate for the number of fur seals in the Eastern Pacific stock is approximately 1,019,192 (Hill *et al.* 1997).

The Alaska population of northern fur seals recovered to approximately 1.25 million in 1974 after the killing of females in the pelagic fur seal harvest was terminated in 1968. The population then began to decrease with pup production declining at a rate of 6.5-7.8 percent per year into the 1980s (York 1987). By 1983 the total stock estimate was 877,000 (Briggs and Fowler 1984). Annual pup production on St. Paul Island has remained relatively stable since 1981, indicating that stock size has not changed much in recent years (York and Fowler 1992). The most recent stock estimates prior to 1994 were 984,000 in 1992, and 1.01 million in 1990 (NMFS 1993). Northern fur seals were listed as depleted under the MMPA in 1988 because population levels had declined to less than 50 percent of levels observed in the late 1950s and no compelling evidence existed that carrying capacity had changed substantially since the late 1950s (NMFS 1993). Under the MMPA, this stock remains listed as depleted until population levels reach at least the lower limit of its optimum sustainable population (estimated at 60 percent of carrying capacity). Regulations were implemented in 1994 (50 CFR 679.22(a)(6)) to create a Pribilof Island Area Habitat Conservation Zone, in part, to protect the Northern fur seals.

NMFS observers monitored incidental take on the BSAI and GOA groundfish trawl, longline, and pot fisheries during 1990-1995. Observed incidental mortality occurred in the BSAI groundfish trawl with a mean annual (total) mortality of three. No mortality in the GOA fisheries was observed (Hill *et al.* 1997).

Harbor seals Harbor seals inhabit coastal and estuarine waters off Baja California, north along the western coasts of the U.S., British Columbia, and southeast Alaska, west through the GOA and Aleutian Islands, and in the Bering Sea north to Cape Newenham and the Pribilof Islands. They haul out on rocks, reefs, beaches, and drifting glacial ice, and feed in marine, estuarine, and occasionally fresh waters.

Three separate stocks of harbor seals are recognized in Alaska waters: (1) The southeast Alaska stock - occurring from the Alaska/British Columbia border to Cape Suckling, (2) the GOA stock - occurring from Cape Suckling to Unimak Pass, including animals throughout the Aleutian Islands, and (3) the Bering Sea stock - including all waters north of Unimak Pass (Hill *et al.* 1997). Population size and mortality rate in the fisheries are calculated separately.

The southeast Alaska stock's most recent comprehensive aerial survey was conducted during the autumn molt in 1993. Utilizing a correction factor to account for harbor seals moving between areas surveyed, the harbor seal population estimate is 37,450 (Hill *et al.* 1997). NMFS monitored harbor seal incidental take in the GOA groundfish trawl, longline, and pot fisheries during 1990-1995. The southeast Alaska harbor seal stock are vulnerable to vessels participating in the GOA groundfish longline fishery. The mean annual (total) mortality rate was 4.0 for the GOA groundfish longline (Hill *et al.* 1997).

The GOA stock was assessed in sections with photographic aerial surveys during the autumn molt in 1991, 1992, and 1994. Utilizing a correction factor to account for harbor seals moving between areas surveyed, the harbor seal population estimate is 23,504 (Hill *et al.* 1997). NMFS monitored harbor seal incidental take in the GOA groundfish trawl, longline, and pot fisheries. The mean annual (total) mortality rate was 1 for the GOA groundfish trawl fishery and 0.2 for the GOA pot fishery (Hill *et al*. 1997).

The Bering Sea stock of harbor seals includes all waters north of Unimak Pass. Photographic aerial surveys were conducted during the autumn molt of 1995 throughout northern Bristol Bay and along the north side of the Alaska Peninsula (Withrow and Loughlin 1996). The corrected estimated abundance for the stock is 13,312 (Hill *et al*. 1997). NMFS monitored harbor seal incidental take in the BSAI groundfish trawl, longline, and pot fisheries. The mean annual (total) mortality rate was 1.2 for the BSAI groundfish trawl fishery, 0.6 for the BSAI longline fishery, and 1.2 for the BSAI pot fishery (Hill *et al*. 1997).

Spotted seals are distributed along the continental shelf of the Beaufort, Chukchi, Bering, and Okhotsk Seas south to the northern Yellow Sea and western Sea of Japan (Shaughnessy and Fay 1977). They are known to occur around the Pribilof Islands, Bristol Bay, and the eastern Aleutian Islands. Of eight known breeding areas, three occur in the Bering Sea. Only one stock, the Alaska stock, is recognized in U.S. waters.

A reliable estimate of spotted seal population abundance is currently not available (Rugh *et al*. 1995). Early estimates of the world population were in the range of 334,000-450,000 animals (Burns 1973). The population of the Bering Sea, including Russian waters, was estimated to be 200,000-250,000 based on the distribution of family groups on ice during the mating season (Burns 1973). Reliable data on trends in population abundance for the Alaska stock of spotted seals are considered unavailable (Hill *et al*. 1997). An element of concern is the potential for Arctic climate change, which will probably affect high northern latitudes more than elsewhere. A shift in regional weather patterns in the Arctic region has been observed over the last 10-15 years (Tynan and DeMaster 1996). Ice-associated seals, such as the spotted seal, are particularly sensitive to changes in weather and sea-surface temperatures in that these strongly affect their ice habitats. Data are insufficient to make reliable predictions of the effects of Arctic climate change on the Alaska spotted seal stock.

NMFS monitored spotted seal incidental take in the BSAI groundfish trawl, longline, and pot fisheries during 1990-1995. Observers did not report any mortality or serious injury of spotted seals incidental to these groundfish fisheries (Hill *et al*. 1997).

Bearded seals are circumpolar in their distribution, extending from the Arctic Ocean south to Hokkaido in the western Pacific. In Alaskan waters, bearded seals are distributed over the continental shelves of the Bering, Chukchi, and Beaufort Sea (Ognev 1935; Johnson *et al*. 1966; Burns 1981a). Only one stock, the Alaska stock, is recognized in U.S. waters.

Early estimates of the Bering-Chukchi Sea population range from 250,000 to 300,000 (Popov 1976; Burns 1981a). Until additional surveys are conducted, reliable estimates of abundance for the Alaska stock of bearded seals are considered unavailable. Reliable data on trends in population abundance are likewise unavailable, and no evidence exists that population levels are declining. The concern expressed above regarding regional weather patterns for spotted seals applies as well to bearded seal (Hill *et al.* 1997).

NMFS monitored bearded seal incidental take in the BSAI groundfish trawl, longline, and pot fisheries during 1990-1995. Incidental kill was observed for the Bering Sea trawl fishery of three mortalities in 1991 and four in 1994, which calculates to be a mean annual (total) mortality rate of two bearded seals per year (Hill *et al.* 1997).

<u>Ringed seals</u> have a circumpolar distribution occurring in all seas of the Arctic Ocean (King 1983). In the eastern North Pacific, they are found in the southern Bering Sea and range as far south as the Seas of Okhotsk and Japan. Only one stock, the Alaska stock, is recognized in U.S. waters.

A reliable abundance estimate for the Alaska stock of ringed seals is currently not available. Crude estimates of the world population have ranged from 2.3 to 7 million, with 1 to 1.5 million in Alaskan waters (Kelly 1988). The most recent abundance estimates of ringed seals are based on aerial surveys conducted in 1985, 1986, and 1987 by Frost *et al.* (1988) but for only a limited portion of the shorefast ice habitat. Reliable data on trends in population abundance for the Alaska stock of ringed seals are unavailable and no evidence exists that population levels are declining. The concern expressed above regarding regional weather patterns for spotted seals applies as well to ringed seal.

NMFS monitored ringed seal incidental take in the BSAI groundfish trawl, longline, and pot fisheries during 1990-1995. Incidental kill observed for the Bering Sea trawl fishery was two mortalities in 1992 which calculates to be a mean annual (total) mortality rate of 0.6 ringed seals per year (Hill *et al.* 1997).

<u>Ribbon seals</u> inhabit the North Pacific Ocean and adjacent fringes of the Arctic Ocean. In Alaskan waters, ribbon seals are found in the open sea, on the pack ice, and only rarely on shorefast ice (Kelly 1988). They range northward from Bristol Bay in the Bering Sea into the Chukchi and western Beaufort Seas. Only one stock, the Alaska stock, is recognized in U.S. waters.

A reliable abundance estimate for the Alaska stock of ribbon seals is currently not available. Burns (1981b) estimated the worldwide population of ribbon seals at 240,000 in the mid-

1970s, with an estimate for the Bering Sea at 90,000-100,000. Reliable data on trends in population abundance for the Alaska stock of ribbon seals are unavailable and no evidence exists that population levels are declining. The concern expressed above regarding regional weather patterns for spotted seals applies as well to ribbon seal.

NMFS monitored ribbon seal incidental take in the BSAI groundfish trawl, longline, and pot fisheries during 1990-1995. Incidental kill observed for the Bering Sea trawl fishery was one mortalities both in 1990 and 1991 which calculates to be a mean annual (total) mortality rate of 0.2 ribbon seals per year (Hill *et al.* 1997).

3.1.2.2 Status of Marine Mammal Cetacean Species

Large cetaceans with ranges (or historical occurrence) in the areas of the fisheries include humpback, grey, sei, fin, blue, right, sperm, minke, and bowhead whales (Bering Sea only). Small cetaceans include beluga whales, killer whales, Pacific white-sided dolphin, harbor porpoise, Dall's porpoise. Population estimates and status determinations of most stocks of small cetaceans are poorly known. Cetacean species may interact with groundfish fisheries either in the fisheries themselves through potential entanglements/entrapments and possibly mortalities, or through competition for prey directly or indirectly. NMFS (1991a) reviewed population status of the ESA listed great whales throughout the world. Hill *et al.* (1997) reviewed stock status and potential biological removals by fisheries of all cetaceans. New information on the population status and management actions concerning Cetaceans is summarized below.

<u>Beluga whales</u> Beluga whales are distributed throughout seasonally ice-covered Arctic and subarctic waters of the Northern Hemisphere (Gurevich 1980). Five stocks of beluga whales are recognized within U.S. waters: Cook Inlet, Bristol Bay, Eastern Bering Sea, Eastern Chukchi Sea, and Beaufort Sea (Hill *et al.* 1997). The two stocks within the management areas are Bristol Bay and the Eastern Bering Sea. The total corrected population abundance estimate for Bristol Bay is 1,316, and the Eastern Bering Sea is 7,986 (Hill *et al.* 1997). The Eastern Bering Sea population is less likely to be declining than it is to be stable or increasing (Hill *et al.* 1997) and the Bristol Bay population is considered stable (Frost and Lowry 1990; Shelden 1994). NMFS monitored beluga incidental take in the BSAI groundfish trawl, longline, and pot fisheries during 1990-1994. No mortality or serious injuries were observed incidental to these groundfish fisheries (Hill *et al.* 1997).

<u>Killer whales</u> have been observed in all oceans and sea of the world (Leatherwood and Dahlheim 1978). In Alaska waters, killer whales occur along the entire Alaska coast from the Chukchi Sea, into the Being Sea, along the Aleutian Islands, GOA, and into

southeast Alaska (Braham and Dahlheim 1982). Four killer whale stocks are recognized along the west coast of North America from California to Alaska with two of them occurring in Alaska, the Eastern North Pacific Northern Resident stock and the Eastern North Pacific Transient stock (Hill *et al.* 1997). The combined count of resident killer whales in Alaskan waters is 601 and transient whales is 187 (Dahlheim and Waite 1993; Dahlheim 1994; Dahlheim *et al.* 1996). Reliable data on trends in population abundance for either stock are considered unavailable (Hill *et al.* 1997).

NMFS observers monitored incidental take on the BSAI and GOA groundfish trawl, longline, and pot fisheries during 1990-1995. Observed incidental mortality occurred in the BSAI groundfish trawl and longline fisheries with a mean annual (total) mortality of 1.0 for BSAI trawl and 0.4 for BSAI longline. No killer whale mortality was observed by NMFS in the pot fisheries (Hill *et al.* 1997). Killer whale have added interaction with the longline fisheries in that some individuals feed off longline gear as it is being retrieved (Dahlheim 1996).

Pacific White-Sided dolphins are found throughout the temperate North Pacific Ocean. In the eastern North Pacific the species occurs from the Southern Gulf of California, north to the GOA, west to Amchitka in the Aleutian Islands, and is rarely encountered in the southern Bering Sea. Two stocks are recognized in the Pacific Ocean with the Central North Pacific stock the one present in the BSAI and GOA management areas (Hill *et al.* 1997). Buckland *et al.* (1993a) calculated population abundance at 931,000 animals. Buckland *et al.* (1993a), however, suggested that Pacific white-sided dolphins show strong vessel attraction. A correction factor has not been estimated, but abundance estimates may be biased upwards by more than five-fold. No reliable information exists on trends in abundance for the stock.

NMFS observers monitored incidental take on the BSAI and GOA groundfish trawl, longline, and pot fisheries during 1990-1995. The mean annual (total) mortality rate for the Bering Sea groundfish trawl fishery is 0.2 and the Bering Sea groundfish longline fishery is 0.8 (Hill *et al.* 1997).

Harbor porpoises in the eastern North Pacific Ocean range from Point Barrow, along the Alaskan coast, and down the west coast of North America to Point Conception, California (Gaskin 1984). Available data are insufficient to justify recognizing three biological stocks of harbor porpoise in Alaska, however three separate management units are established (southeast Alaska, GOA, and Bering Sea stocks). Estimated corrected abundance for the three stocks is 29,744 animals. No reliable information on trends in abundance exists (Hill *et al.* 1997).

NMFS observers monitored incidental take on the BSAI and GOA groundfish trawl, longline, and pot fisheries during 1990-1995.

No mortalities were observed for the southeast Alaska or GOA stocks incidental to commercial fisheries. One harbor porpoise mortality was observed in the 1994 Bering Sea groundfish trawl fishery. The mean annual (total) mortality rate resulting from the observed mortality was 0.75 (Hill *et al.* 1997).

<u>Dall's porpoises</u> are widely distributed across the entire North Pacific Ocean (Leatherwood and Reeves 1983). One stock of Dall's porpoise is recognized in Alaska waters (Hill *et al.* 1997). The Alaska stock of Dall's porpoise is estimated at 417,000. This number, however, may be overestimated by as much a five fold because of vessel attraction behavior (Hill *et al.* 1997; Turnock and Quinn 1991). Therefore a corrected population estimate is 83,400 for this stock. No reliable information on trends in abundance exists (Hill *et al.* 1997).

NMFS observers monitored incidental take on the BSAI and GOA groundfish trawl, longline, and pot fisheries during 1990-1995. No mortalities of Dall's porpoise were observed by NMFS in either pot fishery. The mean annual (total) mortality was 4.6 for the BSAI groundfish trawl fishery, 0.6 for the GOA groundfish trawl fishery, and 1.6 for the BSAI groundfish longline fisheries (Hill *et al.* 1997).

<u>Sperm whales</u> are distributed widely in the North Pacific from Cape Navarin to the Pribilof Islands (Omura 1955). They feed primarily on medium-sized to large-sized squids (Gosho *et al.* 1984). One stock is recognized in Alaska, the North Pacific stock (Hill *et al.* 1997). The number of sperm whales occurring within Alaskan waters is unknown. Reliable information on trends in abundance are currently not available (Hill *et al.* 1997).

NMFS observers monitored incidental take on the BSAI and GOA groundfish trawl, longline, and pot fisheries during 1990-1995. No mortalities were observed, however, sperm whale interaction with fisheries operating in the GOA are known to occur and may be increasing in frequency. In the first six months of 1996, NMFS observers aboard longline vessels targeting both sablefish and halibut have documented sperm whales feeding off the longline gear (NMFS Observer Program, unpubl. data, NMFS, AFSC, 7600 Sand Point Way NE, Seattle, WA, 98115).

<u>Beaked whales</u> present include the Baird's, Cuvier's, and Stejneger's. Baird's beaked whale extends north to at least the Pribilof Islands (Balcomb 1989), Cuvier's range to southeastern Alaska and the Aleutian and Commander Islands (Rice 1986), and Stejneger's north through the GOA to the Aleutian Islands, into the Bering Sea to the Pribilof and Commander Islands (Loughlin and Perez 1985). Reliable estimates of population size or trends in population abundance are unavailable (Hill *et al.* 1997).

NMFS observers monitored incidental take on the BSAI and GOA groundfish trawl, longline, and pot fisheries during 1990-1994. No mortalities were observed (Hill *et al*. 1997).

<u>Gray whales</u> migrate near shore along the coast of North America from Alaska to the central California coast (Rugh *et al.* 1993). Two stocks are recognized in the North Pacific, the eastern Pacific stock and the western Pacific or "Korean" stock. Most of the eastern North Pacific stock spends the summer feeding in the northern Bering, Chukchi, and Beaufort Seas (Rice and Wolman 1971). The eastern North Pacific stock abundance estimate is 22,571 (Hobbs *et al*. 1996). The population has been increasing over the past several decades with estimated annual rate of increase at 3.29 percent (Buckland *et al*. 1993b).

NMFS observers monitored incidental take on the BSAI and GOA groundfish trawl, longline, and pot fisheries during 1990-1995. No mortalities were observed (Hill *et al*. 1997).

<u>Humpback whales</u> in the North Pacific are seasonal migrants that feed on zooplankton and small schooling fishes (NMFS 1991b). The historic summering range in the North Pacific encompasses coastal and inland waters around the Pacific rim from Point Conception, California, north to the GOA and the Bering Sea, and west along the Aleutian Islands to the Kamchatka Peninsula and into the Sea of Okhotsk (Tomlin 1967; Nemoto 1957; Johnson and Wolman 1984). The humpback whale population in much of this range was considerably reduced as a result of intensive commercial exploitation during this century. Four stocks are recognized in the North Pacific: The two that come to Alaska are the Central North Pacific, and the Western North Pacific. No reliable abundance estimate or information on trends in abundance exists for the Western North Pacific stock (Hill *et al*. 1997). The Central North Pacific stock is more well known in terms of feeding aggregations in Prince William Sound and southeastern Alaska (Baker *et al*. 1986). Baker and Herman (1987) estimated the stock at 1,407 animals between 1980-1983. The robustness of that estimate is questionable, however, due to opportunistic nature of the survey methodology in conjunction with a small sample size. A current abundance estimate is considered unknown though the stock is believed to have increased since those data were collected (DeMaster 1995).

NMFS observers monitored incidental take on the BSAI and GOA groundfish trawl, longline, and pot fisheries during 1990-1995. No mortalities were observed (Hill *et al*. 1997).

<u>Fin whales</u> in the North Pacific Ocean can be found from above the Arctic Circle to lower latitudes of around 20 degrees North (Leatherwood *et al*. 1982). Within U.S. waters in the Pacific, fin whales are distributed seasonally off the coast of North America and near and around the waters of Hawaii. The fin whales present in the GOA and Bering Sea are considered part of the Alaska (Northeast Pacific) stock. Reliable estimates of

current and historical abundance or population trends for the Alaska stock are not available (Hill *et al.* 1997).

NMFS observers monitored incidental take on the BSAI and GOA groundfish trawl, longline, and pot fisheries during 1990-1995. No mortalities were observed (Hill *et al.* 1997).

Minke whales occur from the Bering and Chukchi Seas south to near the equator (Leatherwood *et al.* 1982). Minke whales are relatively common in the Bering and Chukchi Seas and in the inshore waters of the GOA (Mizroch 1992). Minke whales in Alaska are considered a separate stock from those in California, Oregon, and Washington. No estimates have been made for the number of minke whales in the entire North Pacific or for the number that occur in waters off Alaska. No data exist on trends in abundance in Alaskan waters (Hill *et al.* 1997).

NMFS observers monitored incidental take on the BSAI and GOA groundfish trawl, longline, and pot fisheries during 1990-1995. No mortalities were observed during that time. One minke whale mortality was observed in 1989 in the Bering Sea/GOA joint-venture groundfish trawl fishery, the predecessor to the current Alaska groundfish trawl fishery (Hill *et al.* 1997).

Northern Right whales exceeded 11,000 animals before the stock was exploited (NMFS 1991c). Based on sighting data, Wada (1973) estimated a total population of 100-200 in the North Pacific. Rice (1974) stated that only a few individuals remained in the eastern North Pacific stock, and that for all practical purposes was extinct because no sightings of a cow with calf have been confirmed since 1900. On July 30, 1996, however, a group of 3-4 right whales were sighted in western Bristol Bay. The group appeared to include a juvenile animal (Goddard and Rugh, in press). A reliable estimate of abundance for the North Pacific right whale stock is not available nor is there any estimate of population trend (Hill *et al.* 1997).

In 1983, a right whale was reported to be incidentally killed in a gillnet in Russian water (NMFS 1991c). Gillnets were also implicated in the death of another right whale off the Kamchatka Peninsula in October of 1989 (Kornev 1994). (Gillnets are not an authorized gear as defined at 50 CFR 679.2 in the Federally managed groundfish fisheries off Alaska.) No other incidental takes of right whales have occurred in the North Pacific. Any mortality incidental to commercial fisheries would be considered significant (Hill *et al.* 1997).

Bowhead whales are distributed in seasonally ice-covered waters of the Arctic and near-Arctic, generally north of 54 degrees North (Moore and Reeves 1993). The largest remnant population, and only stock found within U.S. waters is the Western Arctic stock. The stock migrates annually from wintering areas in the northern Bering Sea, through the Chukchi Sea to the Beaufort Sea (Braham *et al.* 1980). The Western Arctic stock is estimated at

8,200 animals (Anon. 1996) and increasing at a rate of 3.1 percent from 1978 to 1993, when abundance increased from approximately 5,000 to 8,000 whales (Raftery *et al.* 1995).

No observer program records of bowhead whale mortality incidental to commercial fisheries in Alaska exist (Hill *et al.* 1997).

3.1.2.3 Status of Seabirds

Alaska supports North America's greatest concentration of seabirds, owing to its productive marine waters and abundant nesting habitat. Approximately 38 species of seabirds nest in Alaska, including 36 million birds at 470 colonies in the BS/AI and 12 million birds at 20,000 colonies in the GOA. In addition, up to 50 million shearwaters and three albatross species feed in Alaskan waters but breed farther south. Alaskan seabirds are members of the orders Procellariiformes, Pelecaniformes, and Charadriiformes. Characteristics of seabird populations vary among species, but general features include delayed maturity (breeding starts at two to nine years of age), long life (annual adult survival rates are 0.80-0.96), and low reproductive rates (approximately 0.2-1.5 young fledged annually).

Seabirds have been studied in the Bering Sea and GOA since the early 1970's. The location, species composition, and approximate size of breeding colonies are stored in a database at the USDI Fish and Wildlife Service (FWS) office in Anchorage, Alaska.

Population trends and productivity are monitored by FWS every one to three years at approximately six colonies in each area. The species monitored are common and thick-billed murres, red-legged and black-legged kittiwakes, northern fulmar, tufted puffin, fork-tailed and Leach's storm-petrel, and red-faced and pelagic cormorant. Diets also are monitored in some studies. Populations of marine seabirds are monitored on the water along parts of Kodiak Island and in Prince William Sound and Cook Inlet.

Some seabird populations in the Bering Sea, Aleutian Islands, and GOA regions have declined during part or all of the past two decades. Most declines were concentrated on islands of the southeastern Bering Sea and in the northern GOA. The principal colony of the red-legged kittiwake on St. George Island has declined by almost 50 percent from 1975 to 1989 (Hatch *et al.* 1993), but has since shown signs of increasing (Byrd and Dragoo 1997). Other species on the Pribilofs have declined to a lesser extent increased (Climo 1993; Dragoo and Sundseth 1993; Byrd and Dragoo 1997). In the northern GOA, declines have been documented in several species, including Pigeon Guillemots and Marbled Murrelets (Hatch *et al.* 1993; Klosiewski and Laing 1994; Kuletz 1996; Oakley and Kuletz 1996; Piatt and Anderson 1996).

These declines probably began before the *Exxon Valdez* oil spill. Populations in other areas generally have been stable or have increased (reviewed in Hatch and Piatt 1995; National Research Council 1996).

Most population trends in high-latitude seabirds have been associated with changes in food availability (Birkhead and Furness 1985; Piatt and Anderson 1996). The most serious non-food threat to seabird populations in Alaska has been (and remains) the introduction of alien predators, both foxes (Bailey 1993) and rats that might be introduced from vessels (Loy 1993). Oil spills may cause declines in some colonies, but even the *Exxon Valdez* spill may have affected populations less than changes in food supply and habitat (Hatch and Piatt 1995; Piatt and Anderson 1996).

Trophic relationships -- Seabirds nest on steep seacoasts or remote islands and spend up to 80 percent of their lives at sea. Food is obtained at sea by picking prey from the surface or by diving and pursuing it underwater. Forage fish are the principal diet of more than two-thirds of seabirds that occur in Alaska. The only seabird species that do not depend on fish during the breeding season are very small ones such as auklets. The four seabirds that commonly visit Alaskan waters during their nonbreeding season also depend on forage fish here. Capelin and sand lance are crucial to many bird species; other forage fish include Myctophids, herring, Pacific saury, and walleye pollock. Many seabirds can subsist on a variety of invertebrates and fish during nonbreeding months but can only raise their nestlings on forage fish (Sanger 1987; Vermeer *et al.* 1987).

Seabird population trends are largely determined by forage fish availability (Birkhead and Furness 1985). Although seabirds are adapted to occasional years of poor reproduction, a long-term scarcity of forage fish leads to population declines, usually through breeding failure rather than adult mortality. Seabirds depend on forage fish that are small (5 to 20 cm), high in energy content, and form schools within efficient foraging range of the breeding colony. Seabirds such as kittiwakes and terns can take prey only when they are concentrated at the surface. These species are affected more frequently by food shortage than are diving seabirds such as murres, murrelets, puffins, and cormorants.

Although seabirds consume several species of fish, only one or two forage species are available near most colonies. If an important fish stock is depleted locally, birds may have no alternative and breeding fails (Springer 1991).

Die-off of seabirds in Alaska in summer 1997--An extensive seabird die-off occurred in Alaska in summer 1997. Larger than normal numbers of dead birds were reported on beaches and the water from both sides of the Alaska Peninsula to Adak, Bristol

Bay, the Chukchi Sea, and even Anadyr (Russia). Only a few species were affected; Short-tailed Shearwaters, Black-legged Kittiwakes, and murres. All other species, with a few localized exceptions, apparently were unaffected (V. Mendenhall per com).

Short-tailed Shearwaters died throughout the area, from the end of July to late August. Other species died in some regions: Black-legged Kittiwakes on the Alaska Peninsula in early August, and murres and some other species in small parts of the west and north from May through August. Mortality lasted about a week in each area. Total mortality may never be known but probably exceeded 100,000.

This die-off was very widely reported, considering that the entire area has no roads and few human residents. Calls came from villagers, fishermen, onshore processors, and biologists. Ground surveys were conducted on 21 beaches and aerial surveys on four. Cooperators sent specimens from 20 locations. Information was received and coordinated by FWS. Local reports provided invaluable data on the timing and extent of the die-off.

Numerous reports were received of birds behaving unusually. Flocks of shearwaters were seen feeding much closer to shore than usual. Shearwaters and kittiwakes were attempting to grab food from fishing gear and vessels. Flocks commonly included moribund birds that did not fly at the approach of a vessel. Dead birds were emaciated and light in weight; autopsies revealed no bacterial or viral diseases. All these things suggest that starvation was the cause of death.

The seabird die-off apparently resulted from unusually warm waters in the GOA and Bering Sea. Explanations are derived from a combination of ongoing research and educated guesses. Shearwaters in eastern Bristol Bay were unable to find concentrations of Euphausiid zooplankton on which they usually depend (G.L. Hunt pers. comm.). Upwellings that usually provide nutrients to the plankton were absent in that area for part of summer 1997, so the plankton did not grow and multiply normally there. Warm surface waters may cause some forage fish to descent to deeper layers. Diving birds can still obtain fish under such conditions, but surface-feeding birds such as kittiwakes cannot (Baird 1990). Factors that may have contributed to this die-off are still being investigated through analysis of field data from several parts of the state (V. Mendenhall pers. comm.).

Several substantial seabird die-offs have been reported in Alaska in the past. Murres died along the north side of the Alaska Peninsula in April 1970 (Bailey and Davenport 1972); Short-tailed Shearwaters, Black-legged Kittiwakes, and other species died in the GOA and Bering Sea in summer 1983, a year of strong El Niño effects (Hatch 1987); and murres died in the northern GOA in February 1993 (Piatt and Van Pelt 1997). All were ascribed to starvation as a result of unusual sea conditions. None of the past die-offs has been found to reduce breeding populations of seabirds in Alaska significantly. Seabird populations may be more severely affected by gradual, long-term changes in food resources than by short-lived extremes in sea conditions.

The status of the ESA listed bird species are also discussed in section 3.1.5.

3.1.3 Status of Prohibited Species Bycatch

Prohibited species taken incidentally in groundfish fisheries include: Pacific salmon (chinook, coho, sockeye, chum, and pink salmon), steelhead trout, Pacific halibut, Pacific herring, and Alaska king, Tanner and snow crab. The Council recommends PSC limits in tandem with TAC specifications.

Bycatch limits of prohibited species in the groundfish fisheries frequently limit the groundfish fishery reaching the target species TAC specifications. The catches are managed through gear specifications, time-area closures, and bycatch limits. During haul sorting these species or species groups are to be returned to the sea with a minimum of injury except when their retention is authorized by other applicable law.

Pacific salmon production in the northeast Pacific exhibits time and space variability that is correlated with atmospheric and oceanographic dynamics. However, Alaska's Pacific salmon catches have generally increased since the 1970s, and have reached record levels in recent years (Rigby *et al*. 1991; Wertheimer 1997). In 1991, Alaska produced 79 percent of North America's salmon harvest (in numbers of fish), compared to 17 percent from British Columbia and four percent from Washington, Oregon, Idaho, and California (Rigby *et al*. 1991; Canada Department of Fisheries and Oceans 1993; Henry 1993). The hatchery program, begun in 1974 by the State of Alaska, provides 35 million salmon in the commercial catch, primarily in pink and chum salmon.

Unless retained for charitable donation, salmon taken as bycatch in the groundfish fisheries must be released. Because of catch trauma, time involved in sorting, and sensitivity of the species, all of the salmon bycatch is assumed to be dead when discarded. In the GOA, there are no salmon bycatch limitations. In the BSAI, bycatch limits for both chinook and non-chinook salmon are set in regulations for a portion of the Bering Sea known as the Catcher Vessel Operational Area (CVOA). If chinook salmon bycatch limits are exceeded in that area, a portion of the CVOA, the chinook salmon savings area, is closed to trawl fishing until April 15. If non-chinook bycatch limits are exceeded, the chum salmon savings area is closed to trawling until October 14. During 1997, neither limit was exceeded. Pacific salmon bycatch data are routinely tabulated by species only for chinook salmon. All other salmon species and steelhead trout are merged as "other salmon". The BSAI 1997 take of chinook salmon was 50,676 fish and 67,510 other salmon (NMFS per. comm. 1997). The GOA 1997 take of chinook salmon was 15,052 fish and 3,433 other salmon (NMFS per. comm. 1997).

Pacific halibut biomass in the Bering Sea increased significantly throughout the 1980s, as did recruitment and catch. Similar increases were estimated to have occurred over the entire range of the species in the northeast Pacific. The International Pacific Halibut Commission (IPHC) (1982) determined that biomass in the 1980s was at a record high level. Halibut abundance declined in the 1990s, although large year classes are expected to maintain commercial fisheries near peak levels for some time. Size of Pacific halibut at the age of maturity (eight years) has been declining for several years, possibly due to increased competition and/or a lower carrying capacity. However, definitive explanations are unavailable. The IPHC introduced a revised population biomass model in December 1996. The new biomass estimates are higher, resulting in increased harvestable amount for many of the management areas.

Annual Pacific halibut prohibited species mortality limits are established for trawl and hook-and-line gear and may soon be established for pot gear. To monitor halibut bycatch mortality allowances and apportionments, NMFS uses observed halibut bycatch rates, assumed mortality rates, and estimates of groundfish catch to project when a fishery's halibut bycatch mortality allowance or seasonal apportionment is reached. NMFS monitors the fishery's halibut bycatch mortality allowances using assumed mortality rates that are based on the best information available, including information contained in the annual SAFE report. When a fishery exceeds its seasonal limit, the entire FMP area is closed for that fishery for the remainder of the season. Pacific halibut PSC limits and assumed mortality rates are published in the 1998 Proposed Specifications for the BSAI and GOA management areas.

Herring biomass in the eastern Bering Sea has ranged between 1,600,000 and 10,000 tons. Large year classes appeared in 1957, 1958 and 1977, years of significant pulse warming in the eastern Bering Sea. These year classes apparently supported the two major increases in population biomass observed over the last four decades (Wespestad 1991).

Herring bycatch in the groundfish fisheries is managed by time area closures that correspond to locations and times of predicted presence of large herring schools. These time area closures are not expected to change between the 1997 and 1998 groundfish fisheries.

Tanner crab and Alaska king crab PSC limits are set in the BSAI groundfish fisheries FMP for Tanner crab and Alaska king crab.

Currently no PSC limit for crab in the GOA groundfish fisheries exists.

Bering Sea Tanner crab stocks are currently at historic low levels based on bottom trawl survey data (Stevens *et al.* 1996). Recruitment and exploitable biomass of Bristol Bay red king crab (*Paralithodes camtschaticus*), Bering Sea Tanner crab (*Chionoecetes bairdi*), and snow crab (*C. opilio*) stocks are near historically low levels. In 1994 and 1995, Bristol Bay was closed to red king crab fishing because the female threshold [8.4 million lb (3,810 mt)] was not reached. Also, the area east of 163 degrees West longitude was closed to Tanner crab fishing to minimize the bycatch of female red king crabs. The 1995 Tanner crab season produced only 4.5 million lb (2,041 mt) for the 196 vessels participating. This amount is the lowest catch since the fishery reopened in 1988.

Concerns by the groundfish fisheries for the crab populations include relative rates of predation by groundfish on crab, bycatch, and benthic habitat alteration that may be result of trawl gear deployment.

3.1.4 Status of Forage Species

Forage fish species that are considered to be primary food resources for other marine animals include Clupeiformes (herring), Osmeridae (which includes capelin and eulachon), Myctophidae, Bathylagidae, *Ammodytes* spp. (sand lance), and Pacific sandfish. In order to prevent the development of a fishery targeting forage fish, NMFS approved Amendments 36 to the BSAI FMP and 39 to the GOA FMP on February 6, 1998. These amendments remove capelin, eulachon, and smelt from the other species category and place them in a new forage fish species category. ABC and TAC amounts will not be specified for forage fish species. Instead, they will be placed on permanent bycatch status with a maximum retainable bycatch amount of 2 percent relative to other retained catch.

With the exception of herring, which are considered prohibited species, forage species not covered by Amendments 36/39 are currently managed in the BSAI and GOA under the "other species" or "non-specified" species categories. This includes species in the families Myctophidae, Bathylagidae as well as *Ammodytes* spp. (sand lance), and Pacific sandfish. For species in the "other species" category, average annual catch is recorded. In the BSAI, a single TAC for the entire "other species" category which also includes octopus, squid, skates, etc is specified. In the GOA, the "other species" category is specified as five percent of the sum of the TAC amounts for all species and species group categories. For forage fish species in the "non-specified" category (sand lance, Pacific sandfish, lanternfish, etc.) a TAC is not specified but is defined in the FMPs as the amount taken incidentally while fishing for other groundfish. No reporting is required and no ABC is estimated for "non-specified" species.

Forage fish perform a critical role in the complex ecosystem by providing the transfer of energy from the primary or secondary producers to higher trophic levels. Many species undergo large, seemingly unexplainable fluctuations in abundance. Most of these species have high reproductive rates, are short-lived, attain sexual maturity at young ages, and have fast individual growth rates (termed r-selected species) such as Walleye pollock, herring, Atka mackerel, capelin, and sand lance. Predators which utilize r-selected fish species as prey, have evolved in an ecosystem in which fluctuations and changes in relative abundances of these species have repeatedly occurred. These species (termed K-selected species) include rockfish, many flatfish, marine mammals, and seabirds. K-selected species have comparatively lower fecundity, higher adult survival rates, and delayed maturity compared to r-selected species. K-selected species, to some degree, are generalists who are not dependent on the availability of a single species to sustain them, but on a suite of species, any one (or more) of which is likely to be available each year.

Some evidence exists, mostly anecdotal, that osmerid abundances, particularly capelin and eulachon, have declined significantly since the mid 1970s. Evidence for this comes from marine mammal food habits data from the GOA (Calkins and Goodwin 1988), as well as from data collected in biological surveys of the GOA (not designed to sample capelin) (Anderson *et al.* 1994) and commercial fisheries bycatch from the eastern Bering Sea (Fritz *et al.* 1993). It is not known, whether smelt abundances have declined or whether their populations have redistributed vertically, due presumably to warming surface waters in the region beginning in the late 1970s. Yang (1993), documented considerable consumption of capelin by arrowtooth flounder, a demersal lower-water column feeder, in the GOA which also indicates redistribution.

Some fish species utilize the same food sources and some fish species are predators of other fishes. The size ranges of prey consumed by fish predators is important to predicting population biomass in future years and competition between species on time-lag basis (overview and references to other studies are found in Livingston *et al.* 1986; Brodeur and Livingston 1988; Livingston 1991; 1993; Livingston *et al.* 1993; and Yang 1993).

3.1.5 Status of ESA Listed Species

The ESA provides for the conservation of endangered and threatened species of fish, wildlife, and plants. The program is administered jointly by the Department of Commerce (NMFS) for most marine species, and the Department of Interior (FWS) for terrestrial and freshwater species.

The ESA procedure for identifying or listing imperiled species involves a two-tiered process, classifying species as either threatened or endangered, based on the biological health of a species. Threatened species are those likely to become endangered in the foreseeable future [16 U.S.C. § 1532(20)]. Endangered species are those in danger of becoming extinct throughout all or a significant portion of their range [16 U.S.C. § 1532(20)].

In addition to listing species under the ESA, the critical habitat of a newly listed species must be designated concurrent with its listing to the "maximum extent prudent and determinable" [16 U.S.C. §1533(b)(1)(A)]. The ESA defines critical habitat as those specific areas that are essential to the conservation of a listed species and that may be in need of special consideration. The primary benefit of critical habitat designation is that it informs Federal agencies that listed species are dependent upon these areas for their continued existence, and that consultation with NMFS on any Federal action that may affect these areas is required. Some species, primarily the cetaceans, listed in 1969 under the Endangered Species Conservation Act and carried forward as endangered under the ESA, have not received critical habitat designations.

Federal agencies have an affirmative mandate to conserve listed species (Rohlf 1989). One assurance of this is federal actions, activities or authorizations (hereafter referred to as federal action) must be in compliance with the provisions of the ESA. Section 7 of the Act provides a mechanism for consultation by the federal action agency with the appropriate expert agency (NMFS or FWS). Informal consultations, resulting in letters of concurrence, are conducted for federal actions not likely to adversely affect the listed species. Formal consultations, resulting in biological opinions, are conducted for federal actions that may have an adverse affect on the listed species. Through the biological opinion, a determination is made as to whether the proposed action poses "jeopardy" or "no jeopardy" of extinction to the listed species. If the determination is that the action proposed (or ongoing) will cause jeopardy, reasonable and prudent alternatives may be suggested which, if implemented, would modify the action such that it no longer posed jeopardy to the listed species. These reasonable and prudent alternatives must be incorporated into the federal action if it to proceed. A biological opinion with the conclusion of no jeopardy may contain a series of management measures intended to further the reduce the negative impacts to the listed species. These management alternatives are advisory to the action agency [50 C.F.R. §402.24(j)]. If a likelihood of any taking[1] occurring during promulgation of the action exists, an incidental take

[1] the term "take" under the ESA means "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct". (16 U.S.C. §1538(a)(1)(B).

statement may be appended to a biological opinion to provide for the amount of take that is expected to occur from normal promulgation of the action.

Listed Species The following species are currently listed as endangered under the ESA and occur in the GOA and/or BSAI groundfish management areas:

Northern Right Whale	*Balaena glacialis*
Bowhead Whale[2]	*Balaena mysticetus*
Sei Whale	*Balaenoptera borealis*
Blue Whale	*Balaenoptera musculus*
Fin Whale	*Balaenoptera physalus*
Humpback Whale	*Megaptera novaeangliae*
Sperm Whale	*Physeter macrocephalus*
Snake River Sockeye Salmon	*Oncorhynchus nerka*
Short-tailed Albatross	*Diomedia albatrus*
Steller Sea Lion[3]	*Eumetopias jubatus*

The following species are currently listed as threatened and occur in the BSAI and GOA management areas:

Snake River Fall Chinook Salmon	*Oncorhynchus tshawytscha*
Snake River Spring/Summer Chinook Salmon	*Oncorhynchus tshawytscha*
Steller Sea Lion[4]	*Eumetopias jubatus*
Spectacled Eider	*Somateria fishcheri*
Steller Eider	*Polysticta stelleri*

Section 7 Consultations Because the groundfish fisheries are federally regulated activities, any negative effects of the fisheries on listed species or critical habitat and any takings that may occur are subject to ESA section 7 consultation. NMFS initiates the consultation with itself in the case of most marine mammals and anadromous species, and with the FWS for the bird species. The resulting letters of concurrence and biological opinions are issued to NMFS. The Council may be invited to participate in the compilation, review, and analysis of data used in the consultations. The determination of whether the action "is likely to jeopardize the continued existence of" endangered or threatened species or to result in the destruction or modification of critical habitat, however, is the responsibility of the appropriate agency (NMFS or FWS). If the action is determined to result in jeopardy, the opinion includes reasonable and prudent measures that are necessary to alter the action so that jeopardy is avoided. If an incidental take of a listed species is expected to occur under normal promulgation of the action, an incidental take statement is appended to the biological opinion.

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[2]species is present in Bering Sea area only.

[3]listed as endangered west of Cape Suckling.

[4]listed as threatened east of Cape Suckling.

Section 7 consultations have been done for all the above listed species, some individually and some as groups. Below are summaries of the consultations.

Endangered Cetaceans In 1991, NMFS concluded a formal section 7 consultation on the effects of the BSAI and GOA groundfish fisheries on endangered cetaceans within the BSAI and GOA (NMFS 1991d). The determination was the fisheries are unlikely to jeopardize the continued existence or recovery of endangered whales. Consideration of the bowhead whale as one of the listed species present within the area of the Bering Sea fishery was not recognized in the 1979 opinion, however, its range and status are not known to have changed. No new information exists that would cause NMFS to alter the conclusion. NMFS has no plan to reopen Section 7 consultations on the listed cetaceans during the 1998 TAC specification process. Of note, however, are observations of Northern Right Whales during Bering Sea stock assessment cruises in the summer of 1997 (NMFS per. com). Prior to these sightings, and one observation of a group of two whales in 1996, confirmed sightings had not occurred in decades.

Steller sea lion The Steller sea lion range extends from California and associated waters to Alaska, including the GOA and Aleutian Islands, and into the Bering Sea and North Pacific and into Russian waters and territory. The species was first listed as threatened throughout its range in 1990 (60 FR 51968). In 1997, based on biological information collected since the species was listed, NMFS reclassified Steller sea lions as two distinct population segments under the ESA (62 FR 24345). The Steller sea lion population segment west of 144°W. longitude (a line near Cape Suckling, Alaska) is listed as endangered; the remainder of the U.S. Steller sea lion population maintains the threatened listing.

NMFS designated critical habitat in 1993 (58 FR 45278) for the Steller sea lion based on the Recovery Team's determination of habitat sites essential to reproduction, rest, refuge, and feeding. Listed critical habitats in Alaska include all rookeries, major haul-outs, and specific aquatic foraging habitats of the BSAI and GOA. The designation does not place any additional restrictions on human activities within designated areas. No changes in critical habitat designation were made as result of the 1997 relisting.

Beginning in 1990 when Steller sea lions were first listed under the ESA, NMFS determined that both groundfish fisheries may adversely affect Steller sea lions, and therefore conducted Section 7 consultation on the overall fisheries (NMFS 1991d), and subsequent changes in the fisheries (NMFS 1992). The 1991 biological opinion concluded no jeopardy but that changes in the temporal and spatial distribution of the pollock fishery may have contributed to the Steller sea lion decline. Specifically, the fishery operated more in fall and winter, caught the quota in less time, and fished more often in areas that would be designated as critical habitat.

In response, NMFS promulgated a series of management regulations in 1991-93, including: 1) spatial allocation of the quarterly GOA pollock catch quota among three areas in the GOA (Areas 610, 620, and 630); 2) limitation of the amount of unharvested pollock from one quarter that was available for harvest in subsequent quarters (temporal allocation); 3) prohibition of trawl fishing within 10 nm of all sea lion rookeries west of 150°W; and prohibition of trawl fishing within 20 nm of six sea lion rookeries in the eastern Aleutian Islands during the BSAI winter pollock roe fishery. The regulatory intent was to disperse trawl fisheries in time and space, exclude them from some important sea lion habitats, and minimize the likelihood that groundfish fisheries would create localized depletions of sea lion prey. Catch was also allocated for Atka mackerel in the Aleutian Islands among three districts (areas 541, 542, and 543) where similarly increasing spatial compression of the fishery led to concerns about its effects on the long-term recruitment and sustainability of this locally aggregated species. While dispersal of the Atka mackerel quota was initiated to conserve fish, it was also consistent with the objectives of the four fishery management measures enacted for Steller sea lion recovery.

The biological opinion on the BSAI and GOA fisheries effects on Steller sea lions issued January 26, 1996 (NMFS 1996) concluded that these fisheries and harvest levels are unlikely to jeopardize the continued existence and recovery of the Steller sea lion or adversely modify critical habitat. NMFS reinitiated consultation to consider the localized harvest of Atka mackerel in the Aleutian Islands and the potential implications for the western (endangered) population of Steller sea lions. After reviewing the current status of the Steller sea lion, the environmental baseline for the action area, and the effects of the 1998 Atka mackerel fishery, and the cumulative effects, it is the agency's biological opinion that the 1998 Atka mackerel fishery, as proposed, is not likely to jeopardize the continued existence of the Steller sea lion and is not likely to destroy or adversely modify critical habitat (NMFS 1998). The opinion also states consultation (for Steller sea lions) must be reinitiated for the 1999 fishery (NMFS 1998).

Pacific Salmon No species of Pacific salmon originating from freshwater habitat in Alaska are listed under the ESA. These listed species originate in freshwater habitat in the headwaters of the Columbia (Snake) River. During ocean migration to the Pacific marine waters a small (undetermined) portion of the stock go into the GOA as far east as the Aleutian Islands. In that habitat they are mixed with hundreds to thousands of other stocks originating from the Columbia River, British Columbia, Alaska, and Asia. The listed fish are not visually distinguishable from the other, unlisted, stocks. Mortal take of them in the chinook salmon bycatch portion of the fisheries is assumed based on sketchy abundance, timing, and migration pattern information.

NMFS designated critical habitat in 1992 (57 FR 57051) for the for the Snake River sockeye, Snake River spring/summer chinook, and Snake River fall chinook salmon. The designations did not include any marine waters, therefore, does not include any of the habitat where the groundfish fisheries are promulgated.

NMFS has issued two biological opinions and no-jeopardy determinations for listed Pacific salmon in the Alaska groundfish fisheries (NMFS 1994; 1995). Conservation measures were recommended to reduce salmon bycatch and improve the level of information about the salmon bycatch. The no jeopardy determination was based on the assumption that if total salmon bycatch is controlled, the impacts to listed salmon are also controlled. The incidental take statement appended to the second biological opinion allowed for take of one Snake River fall chinook and zero take of either Snake River spring/summer chinook or Snake River sockeye, per year. As explained above, it is not technically possible to know if any have been taken. Compliance with the biological opinion is stated in terms of limiting salmon bycatch per year to under 55,000 and 40,000 for chinook salmon, and 200 and 100 sockeye salmon in the BSAI and GOA fisheries, respectively.

Short-tailed albatross The entire world population in 1995 was estimated as 800 birds; 350 adults breed on two small islands near Japan (H. Hasegawa per. com.). The population is growing but is still critically endangered because of its small size and restricted breeding range. Past observations indicate that older short-tailed albatrosses are present in Alaska primarily during the summer and fall months along the shelf break from the Alaska Peninsula to the GOA, although 1- and 2-year old juveniles may be present at other times of the year (FWS 1993). Consequently, these albatrosses generally would be exposed to fishery interactions most often during the summer and fall--during the latter part of the second and the whole of the third fishing quarters.

Short-tailed albatrosses reported caught in the longline fishery include two in 1995, one in October 1996, and none in 1997. Both 1995 birds were caught in the vicinity of Unimak Pass and were taken outside the observers' statistical samples. The 1996 bird was taken near the Pribilof Islands in an observers sample.

NMFS has initiated three formal consultations with the FWS since 1989 on the effects of the groundfish fisheries on the short-tailed albatross. The Biological Opinions concluded that fisheries would not jeopardize the continued existence of that species (FWS 1997; 1995; 1989). The incidental take statement attached to the 1997 opinion is an estimated take of four birds in two years (FWS 1997). The NMFS does not intend to reinitiate consultation for the 1998 TAC specification process.

Spectacled Eider These sea ducks feed on benthic mollusks and crustaceans taken in shallow marine waters or on pelagic crustaceans. The marine range for spectacled eider is not known, although Dau and Kitchinski (1977) review evidence that they winter near the pack ice in the northern Bering Sea. Spectacled eider are rarely seen in U.S. waters except in August through September when they molt in northeast Norton Sound and in migration near St. Lawrence Island. The lack of observations in U.S. waters suggests that, if not confined to sea ice polyneas, they likely winter near the Russian coast (FWS 1993). Although the species is noted as occurring in the GOA and BSAI management areas, no evidence that they interact with these groundfish fisheries exists. In their letter constituting informal consultation on the 1994 TAC specifications, the FWS concurred the spectacled eider would not be adversely affected by the groundfish fisheries (FWS 1994).

Steller Eider The species was listed under ESA as threatened in 1997. Although it is noted as occurring in the GOA and BSAI management areas, no evidence exists that they interact with the groundfish fisheries or compete with the target species for prey. In its letter constituting informal consultation on the 1994 TAC specifications, the FWS concurred the Steller eider, then listed as a category 1 candidate species, would not be adversely affected by the groundfish fisheries due to minimal range overlap (FWS 1994).

Conditions for Reinitiation of Consultation For all ESA listed species, consultation must be reinitiated if: the amount or extent of taking specified in the Incidental Take Statement is exceeded, new information reveals effects of the action that may affect listed species in a way not previously considered, the action is subsequently modified in a manner that causes an effect to listed species that was not considered in the biological opinion, or a new species is listed or critical habitat is designated that may be affected by the action.

3.1.6 Status of the Habitat in the Management Areas

Inclusively all the marine waters and benthic substrates in the management areas comprise the habitat of the target species. Additionally the adjacent marine waters outside the EEZ, adjacent State waters inside the EEZ, shoreline, freshwater inflows, and atmosphere above the waters, constitutes habitat for prey species, other life stages, and species that move in and out of, or interact with, the target species in the management areas. Distinctive aspects of the habitat include water depth, substrate composition, substrate infauna, light penetration, water chemistry (salinity, temperature, nutrients, sediment load, color, etc.), currents, tidal action, plankton and zooplankton production, associated species, natural disturbance regimes, and the seasonal variability of each aspect. Substrate types include bedrock, cobbles, sand, shale, mud, silt, and various combinations of organic material and invertebrates which may be termed biological substrate. Biological substrates present in these management areas include corals, tunicates, mussel beds, tube worms. Biological substrate has the aspect of ecological state (from pioneer to climax) in addition to the organic and inorganic components. Ecological state is heavily dependant on natural and anthropogenic disturbance regimes. Hood and Calder (1981) and Hood and Zimmerman (1987) contain oceanographic descriptions of the North Pacific Ocean specific to the GOA and Bering Sea Aleutian Islands marine habitat. The fishery management plans (NPFMC 1995; 1994) contain some descriptions of habitat preferences of the target species and projects are underway to systematically present biological requirements for each life history stage that are known (NMFS-Council in progress). Much remains to be learned about habitat requirements for most of the target species.

Currently NMFS has no system of evaluating or determining the status of the habitat in the management areas. General acceptance of the concepts of marine carrying capacity and regimes shifts exist, without the methods to describe or define them, except relatively, and then primarily in retrospective terms. Studies are underway to better describe food habits and distributions of juvenile salmon throughout the Gulf of Alaska (NMFS Carrying Capacity Project). Additionally, NMFS has several new studies underway to characterize some effects of trawl gear on benthic habitat. Study design and methods are described (NMFS 1997) though conclusions are some years away. Anthropogenic actions that alter habitat in the management areas include hydrocarbon and chemical spills and discharges, and fishing gear interactions with substrates. Whether these actions are capable of exerting population level influences on the target species is a matter of debate.

The fishing gear associated with the groundfish fisheries of the BSAI and GOA are trawl, longline, and pot gear (C.F.R. 679.2). Impacts associated with these gears are described below:

Trawl Gear The otter trawl is the principle gear used in bottom trawl fisheries in the GOA and BSAI, and advancements in fishing gear and vessel technology have made gear capable of greater substrate alteration. These advances mean that heavier nets are dragging over seabeds, and possibly altering the seafloor more than was observed in earlier studies. Also, larger ships, with greater horsepower and larger, stronger nets are exploring and fishing areas not previously available to the industry (Auster *et al*. 1996). A further consideration is the character of trawling in Alaska has changed from large foreign factory vessels to a mixture of a domestic catcher-processors and numerous smaller catcher vessels since the Magnuson Act of 1976.

Physical effects of trawling include plowing and scraping the seafloor, resuspension of sediment, and lowering of habitat complexity. Plowing and scraping effects depend on towing speed, substrate type, strength of tides and currents, and gear configuration (Jones 1992). It has been found that otter doors tend to penetrate the substrate 1 cm - 30 cm; 1 cm on sand and rock substrates, and 30 cm in some mud substrates (Krost *et al.* 1990; Jones 1992; Brylinsky *et al.* 1994). Another factor which will cause variation in the depth of the troughs made by the otter doors, is the size (weight) of the doors, i.e. the heavier the doors the deeper the trough (Jones 1992). These benthic troughs can last as little as a few hours or days in mud and sand sediments, over which strong tide or current action exists (Caddy 1973; Jones 1992), or they can last much longer, from between a few months to over 5 years, in seabeds with a mud or sandy-mud substrate at depths greater than > 100 m, with weak or no current flow (Krost *et al.* 1990; Jones 1992; Brylinsky *et al.* 1994).

Another aspect of plowing and scraping is the alteration done by the footrope. Once again, different types of footropes will cause more or less alteration. Those footropes which are designed to roll over the seafloor (the type generally, on soft bottoms, employed in the GOA and BSAI), cause little physical alteration, other than smoothing the substrate and minor compression (Brylinsky *et al.* 1994; Kaiser and Spencer 1996). However, since a trawler may re-trawl the same area several times, these minor compressions can cause a "packing" of the substrate (Schwinghammer *et al.* 1996). Further compression of the substrate can occur as the net becomes full and is dragged along the bottom.

The trawling of an area can cause resuspension of both inorganic and organic sediments. Churchill (1989) found that trawling can be a significant contributor to the time-averaged suspended sediment load over heavily trawled areas, especially at depths where bottom stress due to tidal and current action is generally weak. In the GOA, relatively weak current and tidal action near the seafloor exist over much of the groundfish fishing grounds, with a variety of seabed types such as gravely-sand, silty-mud, and muddy to sandy gravel, as well as areas of hard-rock (Hampton *et al.* 1986). The Bering Sea has relatively weak currents, on the other hand, with relatively strong tidal action (currents) accounting for up to 95 percent of all flow as deep as 200 m, with principally gravely-sand and silty-sand seabed (National Research Council 1996).

The reduction in habitat complexity can be examined in two broad categories: 1) small localized changes and 2) larger area changes. The broader area changes refer to the general reductions in habitat complexity with increases in trawling activity (Auster *et al.* 1996; Schwinghammer *et al.* 1996). The small localized changes refer to the smoothing of patchy biogenic depressions, and movement of boulders (Auster *et al.* 1996).

There have been changes to benthic communities from trawling due to habitat alteration. The trawl doors may be the most damaging to benthic organisms on a short-term basis. However, even in deep areas where the troughs may be recognized after long periods (five years), the doors do not likely have an excessive long-term effect on the overall area, because the relatively small trough is between 0.2 - 2 m (Krost *et al.* 1990; Rumohr and Krost 1991; Brylinsky *et al.* 1994). The greater long-term damage to the habitat may be caused by the net and footrope, due to their much larger width, at 3 - 166 m (1.5-90 fathoms), with many between 20-50 m (Graham 1955; Chris Blackburn, Alaska Groundfish Databank, Kodiak, AK, per. com.). The smoothing caused by multiple trawls (as discussed earlier) removes patchy biogenic depressions and moves boulders, both of which are extremely important habitat to juvenile fish and crustaceans (Armstrong *et al.* 1993; Auster *et al.* 1996). Multiple trawls in an area also pack down and lower the complexity of the substrate which will likely reduce the exchange capacity and lead to less species diversity (Jones 1992; Kaiser and Spencer 1996; Schwinghamer *et al.* 1996). Some studies have concluded that trawling tends to favor fast-growing, fast-reproducing and relatively short-lived (r-selected) species such as polychaetes, at the expense of slow-growing, slow-reproducing and relatively long-lived (K-selected) species such as crustaceans (Reise 1982; de Groot 1984; Kaiser and Spencer 1996).

Sediment resuspension, as discussed above, has an effect on the benthic communities as well. Increased sediment suspension can cause reduction of light levels on the seabed, smother benthos following resettlement, create anaerobic conditions near the seabed, and reintroduce toxins that may have settled out of the water column (Churchill 1989; Jones 1992, Messieh *et al.* 1991).

Longline Gear Very little information exists regarding the effects of longlining on benthic habitat. Observations of halibut longline gear made by NMFS scientists during submersible dives off Southeast Alaska provide some information (NPFMC 1992). The following is a summary of these observations: "Setline gear often lies slack on the sea-floor and meanders considerably along the bottom. During the retrieval process the line sweeps the bottom for considerable distances before lifting off the bottom. It snags on whatever objects are in its path, including rocks and corals. Smaller rocks are upended, hard corals are broken, and soft corals appear unaffected by the passing line. Invertebrates and other light weight objects are dislodged and pass over or under the line. Fish, notably halibut, frequently moved the groundline numerous feet along the bottom and up into the water column during escape runs disturbing objects in their path. This line motion was noted for distances of 50 feet or more on either side of the hooked fish."

Pot Gear Pot gear is used in the North Pacific to harvest crabs and groundfish. This gear type likely alters some substrate habitat during the process of setting and retrieving pots; however, no research has been conducted to date.

3.1.7 Socioeconomic Summary

The most recent description of the groundfish fishery is contained in the *Economic Status of the Groundfish Fisheries Off Alaska, 1996* (Kinoshita *et al.* 1997). The report, incorporated herein by reference, presents the economic status of groundfish fisheries off Alaska in terms of economic activity and outputs using estimates of catch, bycatch, ex-vessel prices and value, the size and level of activity of the groundfish fleet, the weight and value of processed products, wholesale prices, exports, and cold storage holdings. The catch, ex-vessel, ex-processor, and fleet size and activity data are for the fishing industry activities that are reflected in Weekly Production Reports, Observer Reports, fish tickets from processors who file Weekly Production Reports, and the annual survey of groundfish processors. All catch data for 1991 through 1996 are based on the blend estimates of total catch which are used by NMFS to monitor groundfish and PSC quotas during each fishing year. External factors included, which in part, determine the economic status of the fisheries are foreign exchange rates, the prices and price indexes of products that compete with products from these fisheries, and fishery imports.

3.1.7.1 Summary of 1996 Exvessel Values

The commercial groundfish catch off Alaska totaled 2.05 million mt in 1996, off 4.3 percent from 1995. The decrease in catch was accompanied by a six percent decline in the average ex-vessel price of groundfish and the estimated ex-vessel value of the catch, excluding the value added by at-sea processing, declined by 9.3 percent from $594 million in 1995 to $538 million in 1996. The value of the 1996 catch after primary processing was estimated at $1.23 billion. The groundfish fisheries accounted for the largest share of the ex-vessel value of all commercial fisheries off Alaska in 1996, while the Pacific salmon fishery was second with $346 million or 29.4 percent of the total Alaska ex-vessel value. The value of the shellfish catch amounted to $175 million or 14.8 percent of the total for Alaska (Kinoshita *et al.* 1997).

The exports of groundfish products from the Pacific Northwest and Alaska have been the driving force behind the growth of the groundfish fisheries off Alaska. The value of edible groundfish exports, including Pacific halibut, increased from $126 million in 1986 to $1.11 billion in 1992, and totaled $916 million in 1996. Exports of groundfish in 1996 accounted for 48.6 percent of all edible fishery products from the Pacific Northwest and Alaska, followed by salmon exports with $645 million or 34.2

percent, and crab exports, with $154 million or 8.2 percent of the total (Kinoshita *et al.* 1997).

During the last ten years, the total catch in the commercial groundfish fisheries off Alaska (including foreign and joint venture fisheries as well as the domestic fishery) varied between 1.85 and 2.38 million t. The peak catch occurred in 1991, in part because blend estimates of catch and bycatch were not yet used to monitor most quotas. If they had been, several fisheries would have been closed earlier in the year (Kinoshita *et al.* 1997).

Average ex-vessel prices, including the value added by at-sea processing, in 1994 were up slightly from $0.102 per pound in 1993 to $0.107 per pound, round weight in 1994. The average price of pollock increased from $0.073 per pound in 1994 to $0.089 in 1996. Average prices of sablefish rose from $0.969 in 1993 to $1.924 in 1996. Pacific cod prices went from $0.220 in 1993 to $0.212 in 1996. Flatfish prices were $0.158 in 1993, rose to $0.181 in 1995, and fell to $0.155 in 1996. Rockfish prices declined from $0.216 in 1992 to $0.181 in 1996. Atka mackerel in 1996 were $0.145. (Kinoshita *et al.* 1997).

Walleye pollock has been the dominant species in the commercial groundfish catch off Alaska. The pollock catch in 1996 totaled 1.27 million t and accounted for 62 percent of the total groundfish catch of 2.05 million t. The pollock catch was down 9.1 percent from 1995. The next major species, Pacific cod, accounted for 309,000 t or 15 percent of the total 1996 groundfish catch. The Pacific cod catch was down slightly from a year earlier. The 1996 catch of flatfish, which includes yellowfin sole, rock sole, and arrowtooth flounder was 276,800 t in 1996, up 4.4 percent from 1995. Pollock, Pacific cod, and flatfish comprised 90.5 percent of the total 1996 catch. Other important species are sablefish, rockfish, and Atka mackerel (Kinoshita *et al.* 1997).

3.1.7.2 Description of the Groundfish Fleet

NMFS blend estimates and fish ticket data were examined to determine the current composition of the domestic groundfish fishing fleet. Preliminary data through June 1995 indicates a total of 1,425 vessels landed groundfish in the GOA and BSAI groundfish fisheries in 1995.

The number of vessels harvesting groundfish off Alaska did not consistently increase, on an annual basis, as did landings. The total number fluctuated from 1,449 in 1986 to 1,859 in 1987, declined to 1,576 in 1989, increased to 2,341 in 1992, and stood at 2,077 in 1994. During this period, the number of trawl vessels increased annually from 80 in 1986 to 296 in 1992, but was 254 in 1994. The greatest impact has been the increase of the largest vessel classes. The number of trawlers greater than 185 feet (56 m) in length increased from 8 in 1987 to 30 in

1989, and to 50 in 1991. However, this group fell to 40 in 1993 but increased to 45 in 1994. From 1986 to 1992, the number of vessels using hook and line gear increased from 1,356 to 1,948, dropped to 1,649 vessels in 1993, then bounced back to 1,807 vessels in 1994. Vessels using pot gear jumped from 24 in 1986 to 285 in 1992, the number declined by one-half to 132 in 1993, but increased by 14 vessels to 146 in 1994.

3.1.7.3 Current Bycatch Management Regime

In the trawl and fixed gear groundfish fisheries, incidental and unintentional harvest is tallied with bycatch. Species included are Pacific halibut, herring, Pacific salmon, Alaska king crab, and Tanner crab. Conflicts arise when bycatch in one fishery reduces the amount of a species available for harvest in another fishery. The bycatch problem is a particularly contentious allocation issue because crab, halibut, herring, and salmon fishers are directing their fisheries to the species that groundfish fishers are harvesting inadvertently. The GOA and BSAI bycatch management measures and associated fishery bycatch apportionments are in Section 3.1.3 of this document and in the SAFE reports (NPFMC 1997a; b).

The Council annually reviews bycatch, including PSC limits, and recommends apportionment of PSC limits to fishery categories as bycatch allowances. Apportionments of PSC limits to the target fisheries are based on the SAFE reports, and discussions by the Advisory Panel, the Scientific and Statistical Committee, and the interested public at the December Council meeting.

Interim closures of fisheries, authorized by the FMPs, are used to control the fisheries so the harvest per fishery stays within allocated amounts. In general, these closures are implemented under a framework established by regulatory amendment. Detailed information concerning bycatch limitations and specific amounts apportioned by gear type and area are found in the annual specification notices (50 CFR part 679). Closures by Federal action from one year to the next are similar in number and timing, though never exactly the same.

Economic discards of target species are another component of bycatch. For the GOA, the overall groundfish discard rates were eight percent for hook and line gear, one percent for pot gear, and 24 percent for trawl gear in 1996. The corresponding groundfish discard rates in the BSAI were 16 percent for hook and line gear, four percent for pot gear, and 13 percent for trawl gear in 1996 (Kinoshita *et al.* 1997).

3.2 Physical and Biological Impacts

Reduction of one component of an ecosystem by fishing can have consequences for other components, especially for predators, competitors, and prey of the target species (National Research

Council 1996). Below are interpretations of the physical and biological impacts of fishing.

Alternative 1 - Implement in 1998, TAC specifications that are equivalent to the 1997 final specifications of TAC.

Alternative 2: Implement the proposed 1998 TAC specifications.

Physical impacts are those that would be caused by (1) trawling activity on the sea bed and associated benthos (i.e., attached animals and plants) and (2) deposition of fish wastes resulting from processing activities. Some disturbance to the benthic environment occurs in all trawl fisheries. Though the total extent of physical impacts is unknown several studies to develop techniques for seafloor habitat impact assessment were initiated by NMFS in 1996 and continued in 1997 (NMFS 1997). It will takes years, perhaps decades, with annual obligation of several million dollars before conclusions can be reached.

Biological impacts on the environment are those caused by changes in the status of target species categories of groundfish, other groundfish species, marine mammals, birds, and other predators and prey. These impacts are discussed below.

3.2.1 Impacts on Target Groundfish Categories

The levels of TAC specifications that are implemented in 1998, as in 1997, will be within the guidelines of the ABC specifications. The ABC specifications are set in a risk adverse manner, based on the best available scientific information as discussed in the SAFE reports (NPFMC 1997a; b) and section 3.1. Overall, they are considerably lower than the associated overfishing levels. In some cases the TAC specifications established are substantially below the ABC levels because of uncertainty in stock assessments or for bycatch considerations. Bycatch restrictions will likely curtail groundfish harvests short of the TAC specified. Thus, the proposed harvest levels are not anticipated to have significant effects on groundfish stocks.

3.2.2 Impacts on Higher Trophic Level Species

Changes in the abundance of high-level predators including marine mammals and birds may be indications of major shifts in the ecosystem. Limited data sets preclude definitive analyses of the effect of fish removals on population trends. The effect of localized prey depletion through fishing activities on high-level predators remains a concern. In addition to changes in food availability, disease, illegal shooting, predation, subsistence harvest, and incidental takes may also contribute to the decline of the Steller sea lion population.

Some populations of marine mammals and seabirds are known to be declining since 1975. These declines may be attributed to the effects of commercial fishing activity off Alaska, however, the complexity of ecosystem interaction and the lack of data make it difficult to sort out how natural and anthropogenic factors have affected the carrying capacity of the ecosystems for marine mammals of the GOA and BSAI. Since first passage of the Magnuson-Stevens Act, the fisheries off Alaska have grown to account for a significant portion of all U.S. seafood landings. Change in food availability is a plausible reason for declining marine mammal and seabird populations; however, research has yet to demonstrate a cause and effect relationship for most species.

3.2.2.1 Marine Mammals

Northern fur seals The population decline evidenced in the 1960s and early 1970s was associated with commercial and scientific harvests in the 1950s and early 1960s (Swartzman and Hofman 1991). Cause(s) of the population decline observed in the late 1970s are largely unknown, but may be related to entanglement in marine debris and discarded fishing gear, incidental take, or reduced prey availability.

Cetaceans The cetacean species present in the GOA and BSAI may interact with fisheries either through a common prey, such as walleye pollock, cod, flatfish, or Atka mackerel (Lowry *et al.* 1989), or by occasionally being caught in trawl nets, currently at the rate of only several per year (Hill *et al.* 1997). The former includes all ten species while the latter includes only the six small-to-medium-sized cetacean species.

Fish comprise varying proportions of the diet of large baleen whales, ranging from approximately 16 percent of the diet of fin whales and 29 percent of the diet of humpback whales to 60 percent of the diet of minke whales (Perez and McAllister 1988). Fish ingested by the large baleen whales are almost exclusively small schooling fish, such as capelin, herring, and eulachon, or juveniles (not recruited to the fishery) of commercially exploited groundfish species, such as pollock, cod, and Atka mackerel. Large baleen whales and the target species of the fisheries therefore compete for food indirectly.

Fish generally comprise a greater proportion of the diet of the smaller cetaceans, with over 50 percent being reported for the killer whale, harbor porpoise, Dall's porpoise, and Beluga whale (Perez and McAllister 1988). These species are considered opportunistic and feed on a wide variety of fish species, including osmerids, clupeoids, gadids, salmonids, myctophids, flatfish, sand lance, and Atka mackerel. Killer whales have been documented to take fish off longlines in the sablefish and Greenland turbot fisheries. Some are incidentally taken in GOA and BSAI fisheries; although current levels of take are not considered significant (Small and DeMaster 1995).

Steller sea lions The Council's Plan Team identified several fishery concerns relevant to the continuing decline of sea lions in the management areas (NPFMC 1997c). One was diet diversity of Steller sea lions. The discussion suggests that sea lions need a variety of prey available, perhaps as a buffer to significant changes in abundance of any single prey. The need to maintain a variety of prey for sea lions was the rationale for the proposal to constrain the Aleutian Island pollock fishery to a bycatch only fishery. Atka mackerel in the Aleutian Islands area is the primary summer prey for sea lions in the area. The Plan Team also recommended the Council consider sea lion population concerns when setting the TAC for Atka mackerel for the Aleutian area (NPFMC 1997c).

An examination of some recent groundfish fishery data could elucidate any changes resulting from the sea lion-fishery measures enacted in 1991-93 (outlined in section 3.1.5). For instance, the spatial distribution of the pollock fishery from 1977 to 1997 would reveal changes in the level of fishing activities in areas utilized by sea lions. In addition, changes in catch per unit effort (CPUE) of the Atka mackerel fishery may show if localized depletions can be related to the fishery. The results of these comparisons may provide a basis for reconsidering whether the fishery causes jeopardy to the species.

Walleye pollock--Prior to the enactment of sea lion protective measures (1977 to 1991), pollock landings doubled from Steller sea lion critical habitat in the BSAI. While 100,000 to 300,000 t were caught annually in 1977 through 1986, 400,000 to 600,000 t were reported from 1987 through 1991. Since 1992, pollock landings from sea lion critical habitat in the BSAI have continued to increase, ranging from 650,000 to 870,000 t. These landings represent an increase from ten percent of the total pollock landings in 1977 to almost 70 percent in 1995. In the GOA, pollock landings from critical habitat increased from trace amounts in 1977 to 1980 to over 220,000 t in 1985, and then declined (as the annual catch quotas declined) to between 43,000 to 63,000 to through 1992. The percentage of total annual GOA pollock catches taken from critical habitat, which increased through 1985, however, remained between 50 percent and 90 percent through 1991.

The spatial compression of the pollock fishery coincided with the decrease in the annual rate of sea lion population decline. This observation is not intended to denote cause and effect; on the contrary, it is stated as a caution regarding casual correlations of data. If fisheries have an effect on sea lion foraging, it is likely to be more complex than an inverse relationship between sea lion numbers and pollock catches from critical habitat (Ferrero and Fritz 1994).

Recent pollock fishery distribution patterns suggest that interactions with sea lions in critical habitats are ongoing despite the partitioning that was achieved in the vicinity of rookeries. In the GOA, the combination of spatial pollock allocations and trawl exclusion zones may have stabilized pollock removals and effort at 1985-91 levels, but did not reduce them. A formal section 7 consultation under the Endangered Species Act was initiated for the final 1998 GOA specifications. In a biological opinion dated March 2, 1998, the Assistant Administrator determined that fishing activities conducted under the final 1998 GOA specifications are not likely to jeopardize the continued existence of the western population of Steller sea lions and is not likely to destroy or adversely modify designated critical habitat for the species in Alaska. The biological opinion also determined that NMFS must implement reasonable and prudent measures to protect Steller sea lions:

1. NMFS will reapportion 10 percent of the 1998 pollock TAC in the combined W/C Regulatory Area from the September 1 season to the June 1 season. This will result in a 25 percent, 35 percent, and 40 percent distribution of pollock TAC among the January 1, June 1, and September 1 seasons, respectively.
2. Reapportionment will take place before the beginning of the June 1 season.

In the BSAI, only broad regional allocation of the pollock quota between the eastern Bering Sea and Aleutian Island management areas is done. The creation of 10 and 20 nm trawl exclusion zones did not constrain landings from important sea lion habitats. Pollock removals from sea lion habitats began increasing prior to the years 1991 to 1993, and it is not known how much the sea lion protective measures may have reduced the rate of increase had they not been enacted. It must be noted that the areas within the existing trawl exclusion zones were not heavily utilized by the BSAI pollock fishery prior to their creation; from 1984 to 1991, the annual percentage of pollock caught within these areas ranged only from one to seven percent. Regardless, recent fishery patterns suggest that to reduce fishery activities within sea lion habitats, refinement of the existing regulations is necessary.

Fishery depletions of atka mackerel in localized areas have been noted. In-season changes in CPUE of the Atka mackerel fishery in the Aleutian Islands and GOA were analyzed using Leslie's method was described by Ricker (1975) to calculate initial stock sizes and harvest rates at four location (Fritz 1997). Atka mackerel harvest rate estimates (catch divided by the Leslie estimate of the initial population size) ranged between 55 percent and 91 percent, considerably larger than the target harvest rates of between 10 percent and 15 percent for the managed populations as a whole (Lowe and Fritz 1996a; b). Evidence from length-frequency distributions and the time-series of CPUE suggested that the exploited populations were not closed, yet the fishery's rates of removal far exceeded rates of immigration. While the origin of the immigrating fish was not known, some may have come from areas within nearby trawl exclusion zones. In one case, after a 7-week gap in landings, fishery CPUEs were still only half those observed at the beginning of the season. Regardless of the impact a series of intense, local fisheries may have on Steller sea lion foraging success (which is unknown), these data suggest that they have occurred despite specific management regulations to disperse fishery effort.

The following target species catch and proposed harvest levels are important relative to Steller sea lions because they are their primary prey species (source: NMFS harvest data):

Management area	target species	1995 catch	1996 catch	1997 catch	1998 TAC
GOA	Pollock	69,855	50,466	89,455	124,730
GOA	P. cod	69,054	69,906	68,284	63,470
GOA	Atka mackerel	701	1,587	331	600
EBS - harvest from Steller sea lion critical habitat (CVOA)	Pollock	harvest from CVOA increased 45% from 1991-1995	harvest in CVOA equal to 1991 level		
EBS non-CVOA	Pollock				
AI	Pollock	60,682	26,597	24,758	23,800
Bogoslof	Pollock	334	390	162	1,000
BSAI	P. cod	245,028	240,674	241,545	210,000
BSAI	Atka mackerel	81,555	103,943	65,833	64,300

Analysis of Alternatives

Alternative 1 would not take into account the most current information available on the status of groundfish species populations.

3.2.2.2 Seabirds

Impacts of fishing activity on seabirds occurs through direct mortality from (1) collisions with vessels, (2) entanglement with fishing gear, (3) entanglement with discarded plastics and other debris, and (4) shooting. Indirect impacts include (1) competition with the commercial fishery for prey, (2) alteration of the food web dynamics due to commercial fishery removals, (3) disruption of avian feeding habits resulting from developed dependence on fishery waste, (4) fish-waste related increases in gull populations that prey on other bird species, and (5) marine pollution and changes in water quality. Competition between seabirds and fisheries for forage fish is difficult to evaluate. Climatic fluctuations undoubtedly contribute to fluctuations in seabird food resources (Wooster 1993), but so may fisheries (Duffy 1983; Steele 1991).

Fish processing provides food directly to scavenging species such as Northern Fulmars and large gulls. This can benefit populations of some species, but it can be detrimental to others which they may displace or prey upon (Furness and Ainley 1984). Predation by birds has impacts on fish populations that have variously been estimated as minor to significant (reviewed by Croxall 1987).

Seabirds are caught incidentally to all types of fishing operations, but the vulnerability of bird species to gear types differs with feeding ecology. As described previously, fishing gear used in these groundfish fisheries include trawl, hook-and-line, and pot. Hook-and-line gear occasionally catches surface-feeding seabirds that are attempting to capture the baits as the line is being set; some birds are caught on hooks and drown. Trawl gear appears to catch surface-feeding and diving birds that are feeding and scavenging fragments of fish as the net is being hauled. Pot gear does not commonly catch birds, though rare reports of dead diving and surface-feeding birds exist for pot gear.

Bycatch of seabirds in groundfish fisheries has been monitored by fishery observers since 1990. Since 1993, observers have been trained by the FWS to identify birds to genus or species. Birds found in the observers' random samples are reported on standard bycatch forms; in addition, Short-tailed Albatrosses are reported whenever they are caught. A preliminary estimate of average annual mortality of seabirds in groundfish fisheries is 9,600 birds (Wohl *et al*. 1995).

Seabirds consume some of the target fish species such as walleye pollock, Atka mackerel, and Pacific herring, although non-target fish and invertebrate species such as capelin, sand lance, squid, and zooplankton generally make up a larger portion of the birds' diets. The fish species consumed by seabirds and harvested in the fisheries are generally of different year classes. Seabirds consume juvenile groundfish age-0 and age-1, while fisheries target the larger fish. Pollock are the only food species of seabirds in the management areas for which large directed fisheries occur. The fishery may have impacted this food source by temporarily depleting forage concentrations near the breeding bird colonies (National Research Council 1996). There may also have been indirect ecosystem effects on other forage species (National Research Council 1996; Piatt and Anderson 1996).

Different levels of harvest yield different amounts of processing wastes which may effect localized seabird populations dependent of the processing wastes. Fish processing provides food directly to scavenging species such as northern fulmars and large gulls. This can benefit populations of some species, but it can be detrimental to others which they may displace or prey upon

(Furness and Ainley 1984). Gulls are attracted to the fish wastes discharged during processing, and may be subject to population expansion in response to sustained processing and discharge activities (Vermeer and Irons 1991). Such artificially expanded gull populations may result in increased predation on other seabird species and displacement of other species from nesting sites. The spectacled eider may be indirectly affected by increased predation by populations of large gulls, that expanded in relation to availability of fish processing wastes. Finally, closures of commercial fisheries and curtailment of processing can stress localized populations of fish-waste dependent seabirds, which then suffer mortality resulting from weakened physical condition or aberrant behaviors (letter FWS to Environmental Protection Agency, September 13, 1994).

Ingestion of plastic debris has become an increasing phenomenon for short-tailed albatrosses, with unknown population effects (FWS 1993).

Declines of some North Pacific seabirds have largely been ascribed to reduced availability of forage fish. Seabirds feed on walleye pollock (exclusively 0- and 1-class fish), herring, and several other forage fish species. Seabirds depend on an adequate abundance and diversity of fish prey in the vicinity of each breeding colony. Prey availability near colonies varies due to current and other abiotic factors, but prey is probably most reliable when overall forage stocks are large.

Based on concerns about future availability of forage fish species, the Council adopted plan amendments to both the GOA and BSAI fishery management plans to prohibit target fisheries on forage fish species, other than those already underway on herring and pollock, from being developed. The intent is to prevent development of new fisheries on underutilized species that may in effect exacerbate efforts to manage declining populations of non-target species such as seabirds and pinniped (62 FR 60682 November 12, 1997).

In accordance with procedures outlined by the FWS to minimize negative interactions between groundfish activities and short-tailed albatross as well as other seabird species, NMFS will continue to (1) maintain and improve observer training in identifying seabirds and reporting the encounters; (2) encourage fishermen to recognize and avoid situations likely to be hazardous to seabirds; and (3) foster improved compliance regarding disposal of debris by ships at sea, as required by the Marine Plastic Pollution Research and Control Act (MARPOL) as well as the International Convention for the Prevention of Pollution by Ships, 1973, with annexes and protocol of 1978 relating to the MARPOL Convention. Effective May 29, 1997, regulations were enacted requiring several operational and gear modifications to vessels fishing hook-and-line gear to minimize the potential for hooking birds during gear deployment (62 FR

23176 April 29, 1997). Similar regulations are underway for the directed halibut fishery.

The 1998 proposed TAC specifications would take into account the most current information regarding the status of individual groundfish species populations. The management measures to minimize negative interactions between groundfish activities and birds would continue regardless of TAC specifications.

3.2.3 Impacts on Prohibited Species

The Council recommends PSC limits and seasonal apportionments of crab, herring, and halibut, and provides bycatch information on other prohibited species annually. Regulations have been implemented to reduce bycatch of red king crab, Tanner crab, halibut, herring, and salmon taken in the groundfish fisheries. The following is a summary of these management measures:

Red King Crab: In June 1996, the Council adopted a stair step based PSC limit for red king crab in Zone 1 as part of the BSAI Groundfish FMP Amendment 37. These will become effective for the 1997 fishery. PSC limits will be based on abundance of Bristol Bay red king crab as follows:

(A) When the number of mature female red king is equal to or below the threshold number of 8.4 million crab, or the effective spawning biomass (ESB) is less than 14.5 million lb (6,577 mt), the Zone 1 red king crab PSC limit would be 35,000 crabs;

(B) when the number of mature female red king crab is above threshold, and the ESB is equal to or greater than 14.5 but less than 55 million lb (24,948 mt), the Zone 1 red king crab PSC limit would be 100,000 crabs; and

(C) when the number of mature female red king crab is above threshold, and the ESB is equal to or greater than 55 million lb (24,948 mt), the Zone 1 red king crab PSC limit would be 200,000 crabs.

The red king crab limit has generally been allocated among the pollock/mackerel/other species, Pacific cod, rock sole, and yellowfin sole fisheries. Once a fishery exceeds its red king crab PSC limit, Zone 1 is closed to that fishery for the remainder of the year, unless further allocated by season.

For 1998, the PSC limit of red king crab in Zone 1 is 100,000 crab. The number of mature female red king crab is estimated to be above the threshold of 8.4 million animals, and the effective spawning biomass is estimated to be greater than 14.5 million lbs (6,577 mt) but less than 55 million lbs (24,948 mt).

Tanner Crab: Separate Tanner (*C. bairdi*) crab PSC limits are set for Zone 1 and Zone 2 of the BSAI. These limits may be further allocated among the pollock/mackerel/other species, Pacific cod, rock sole, turbot/sablefish/arrowtooth, rockfish, and yellowfin sole fisheries. When a fishery exceeds its PSC limit, trawling is closed in that zone for the remainder of the year.

The 1998 Tanner crab PSC limit is 750,000 animals in Zone 1 and 2.1 million animals in Zone 2. These numbers are based on the criteria set out at § 679.21(e)(1)(ii). In Zone 1, Tanner crab abundance is estimated at between 150 million and 270 million animals. In Zone 2, Tanner crab abundance is estimated at between 175 million and 290 million animals.

C. opilio NMFS approved Amendment 40 to the FMP on October 15, 1997. This amendment establishes a PSC limit for *C. opilio* crab based on annual abundance of crab as indicated by trawl surveys. NMFS anticipates that regulations implementing Amendment 40 will be published and effective by mid December 1997. Based on the proposed rule (62 FR 43307, August 13, 1997), the 1998 *C. opilio* PSC limit will be established at 0.1133 percent of the 1997 Bering Sea *C. opilio* crab abundance, or 4,654,000 crab.

Halibut: The most recent information on halibut stocks can be found in the 1998 final SAFE report. The International Pacific Halibut Commission has developed substantially different methods of estimating halibut biomass and stock conditions. These estimates indicate that halibut biomass and recruitment are higher than previously believed. The allowable commercial catch of halibut, which is set by the International Pacific Halibut Commission, will be adjusted to account for the overall halibut PSC limit established for the groundfish fisheries. In the GOA, the PSC limit for halibut is allocated among trawl (2,000 mt of halibut mortality) and hook & line gear (300 mt of halibut mortality). The BSAI annual trawl halibut PSC limit is set in regulations at 3,775 mt mortality. It is allocated among the Pacific cod, yellowfin sole, rock sole, pollock/mackerel/other species, rockfish, and sablefish/turbot/arrowtooth fisheries. For the non-trawl fisheries, the PSC limit is set at 900 mt mortality. To monitor halibut bycatch mortality allowances and apportionments, NMFS uses observed halibut bycatch rates, assumed mortality rates, and estimates of groundfish catch to project when a fishery's halibut bycatch mortality allowance or seasonal apportionment is reached. NMFS monitors the fishery's halibut bycatch mortality allowances using assumed mortality rates that are based on the best information available, including information contained in the annual SAFE report. When a fishery exceeds its seasonal limit, the entire FMP area is closed for that fishery for the remainder of the season.

Herring: The PSC limit of Pacific herring caught while conducting any trawl operation for groundfish in the BSAI is set in regulations as 1 percent of the annual eastern Bering Sea herring biomass. The best estimate of 1998 herring biomass is 157,900 mt. This amount was derived using 1996 survey data and an age-structured biomass projection model developed by the ADFG.

Therefore, the proposed herring PSC limit for 1998 is 1,579 mt. Once the PSC limit has been obtained, one or all of the three designated Herring Savings Areas closes, depending on the time of the year.

Chinook Salmon: The chinook PSC reduction plan established by BSAI Groundfish FMP will close three areas to trawling if and when 48,000 chinook salmon are taken as bycatch. These areas will be then re-opened to trawling on April 16 for the remainder of the year.

Chum Salmon: A chum salmon PSC reduction plan was established by the BSAI Groundfish FMP. Under this plan, the Chum Salmon Savings Area is closed from August 1 to September 1, but this area opens September 2, unless the 42,000 fish limit is reached (accounting to begin August 15 in the catcher vessel only area). Even though the limit is reached, the fishery will open October 15.

No population level effects on stocks of prohibited species are expected under either Alternatives 1 or 2. Specified PSC limits will control total amounts of Pacific halibut, crab, and herring that might be caught as bycatch.

3.2.4 Impacts on Forage Species

Marine ecosystems in the North Pacific Ocean are complex webs of predator/prey relationships. Since the status of each component stock in the groundfish complex in these management areas may change from year to year, predator/prey relationships are also expected to vary. Any amount of groundfish harvest removes animals that otherwise would have remained in the ecosystem where they would have preyed on other animals and/or would be preyed upon. Many of the target species are large-sized fish that prey on juvenile groundfish target species or on other non-target fish and shellfish. The groundfish stocks assessment process includes adjusting for natural mortality and predation although it is limited by incomplete understanding of the dynamic parameters for growth, recruitment, and mortality.

The sum of the proposed 1998 TAC specifications is the same as the sum of the 1997 TAC specifications for the BSAI and somewhat higher than the sum of the 1997 TAC specifications for the GOA. Therefore, if these TAC specifications are implemented in 1998, more groundfish biomass would, in theory, be removed from the ecosystem. The 1998 TAC specifications are close enough to the 1997 TAC specifications to assume food sources available to predators and prey remain constant.

3.2.5 Impacts on ESA Listed Species

Either of the alternatives would have the same approximate effect on the continued recovery, or lack thereof, of ESA listed great whales, Pacific salmon, Steller sea lion, and short-tailed albatross. Sea lion critical habitat designations, the 10 and 20 nm trawl exclusion zones around certain sea lion rookeries, the seabird avoidance devices on longline vessels, the observer program, and the enforcement programs, continue at whatever TAC specifications for the fishery are promulgated. The observer programs result in reliable quantification of any lethal take of Steller sea lions, great whales, and short-tailed albatross. There will continue to be no way to determine if lethal take of ESA listed Pacific salmon occurs.

3.2.6 Impact on the Habitat in the Management Areas

The impacts of fishing gear on seafloor habitats occur in the forms of acceleration of natural disturbance regimes to biological substrate, alteration of the bottom substrate and/or structure, sediment resuspension, and nutrient cycling regimes. Gear specifications, deployment regulations, and harvest allocation percentages to gear types are the same for either alternative. The amount or degree of seafloor habitat altered by fishing gear is not directly correlated to tons of fish harvested. Variables including CPUE and discard/re-fish activities by vessels maximizing the retained catch are assumed to occur with enough frequency to offset any simple correlation between tons of harvest and area of benthic habitat impacted. Less impact results when fewer bottom trawls are deployed, or perhaps more importantly, when bottom gear avoids areas encrusted with biological substrate.

3.3 Socioeconomic Impacts

3.3.1 Impacts on Gross Earnings

The actual value realized from the groundfish harvest is dependent on factors unquantifiable at present, including market demand, costs of harvesting and processing, proportion of catch processed at sea (value added), and the degree to which the harvests are constrained by PSC limits.

For comparative purposes estimates can be made on the gross difference in ex-vessel value of target species. Based on the ex-vessel values ($/lb round weight) shown in paragraph 3.1.7.1, the value of each of the major target species categories can be calculated.

A component of the 1996 Sustainable Fisheries Act amendments to the Magnuson-Stevens Act is the requirement to evaluate affects of changes in TAC on economic value of the harvest. Analysis to predict the 1998 product prices by regulatory area for target species management groups, utilizing the catch specification, bycatch and discard rates is not, however, available. Harvest of flatfish species in amounts well below the approved TAC specification negates any effect the change in TAC specification would have on economic value of those species.

3.3.2 Impacts on Bycatch

The prohibited species bycatch management regime in the GOA and BSAI is the same whatever the annual TAC specification. Bycatch management measures implemented to date specify PSC limits for GOA and BSAI Pacific halibut, and Pacific herring, and BSAI Pacific herring, red king crab, and *C. bairdi* Tanner crab. Attainment of a PSC limit triggers fishery closures that are intended to limit further bycatch amounts of the prohibited species. The PSC limits are set at levels that are not believed to pose biological concern, although significant allocative and other socioeconomic concerns arise when bycatch restrictions imposed on the groundfish fleet reduce revenue to the groundfish industry through foregone groundfish harvests, or to other directed fisheries through reduced quotas to compensate for bycatch removals in the groundfish fisheries. Effects of harvest and PSC limits are analyzed in environmental documents prepared when new or revised seasonal, location or gear regulations are promulgated.

4.0 CONCLUSIONS

Alternative 1 - Implement, in 1998, TAC specifications that are equivalent to the 1997 TAC specifications.

Under this alternative, the sums of the BSAI and GOA TAC specifications in 1998 would be the same as those specified for the 1997 groundfish fisheries in the BSAI and GOA. TAC, ABC and OFL levels for this alternative are shown in Tables 1 and 2 as the 1997 specifications.

Alternative 2: Implement the proposed 1998 TAC specifications.

Under this alternative, the BSAI and GOA TAC specifications are adjusted to include updated surveys and new calculations of ABC and OFL by the Plan Teams and recommended by the Council at its November and December 1997 meetings. Proposed TAC, ABC and OFL levels for this alternative are shown in Tables 1 and 2 as the 1998 proposed specifications.

Alternative 1 would not take into account the most current information available on the status of groundfish species populations. Alternative 2 would take into account the most current information regarding the status of individual groundfish species populations.

<u>Groundfish stocks</u>

Under Alternative 2, 1998 TAC specifications for each target groundfish category are equal to or less than respective ABC specifications, and each ABC is less or equal to the respective OFLs. Under this alternative, the sum of the BSAI and GOA TAC specifications would be 2,000,000 mt and 324,456 mt, respectively. Within the OY, harvests are anticipated to continue to be limited by halibut, herring, salmon, and crab PSC limits in 1998.

Species listed as threatened or endangered under the ESA

Implementing either Alternative 1 or 2 would result in little change in the rate or locations of groundfish removals or in the methods of fishing from those utilized in 1997. As previously determined by NMFS, the groundfish fisheries may have an adverse affect on the Steller sea lion, short-tailed albatross, and listed Pacific salmon.

No consultations with the FWS are presently underway, or considered to be necessary for Short-tailed albatross, Steller's Eider, or Spectacled Eider. No consultations by the NMFS are presently underway, or considered to be necessary, for ESA listed cetaceans, or Pacific salmon. NMFS is appending the 1996 biological opinion for Steller sea lion (NMFS 1998). Pursuant to Section 7 of the ESA, NMFS determines that the groundfish fisheries operating under either the 1997 or the proposed 1998 TAC specifications are unlikely to adversely affect any endangered or threatened species or adversely modify critical habitat in any way or to any additional degree than considered in previous section 7 consultations (all cited in section 3.1.5).

Species prohibited in groundfish fisheries harvest

Neither alternative is expected to adversely affect stocks of fish or invertebrates prohibited in groundfish fisheries harvest. Catches of Pacific halibut, crabs, salmon, and herring are controlled by PSC limits established parallel with the 1998 TAC specification process.

Socioeconomic impacts

Alternatives 1 and 2 are anticipated to have different net economic benefits. The actual value realized is dependent on factors unquantifiable at present, including market demand, costs of harvesting and processing, proportion of catch processed at sea, and the degree to which the TAC specifications are constrained by PSC limits. Additional information is needed to fully assess impacts of commercial fishing activities on marine food webs and ecosystems.

FINDING OF NO SIGNIFICANT IMPACT

For the reasons discussed above, implementation of either Alternative would not significantly affect the quality of the human environment. Therefore, the preparation of an environmental impact statement is not required by section 102(2)(C) of NEPA or its implementing regulations.

MAR 3 1998
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And the Draft EA was distributed freely (150+ copies) to attendees at the December 1996 meeting of the North Pacific Fishery Management Council

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